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VICTORIA.

DEPARTMENT OF MINES.

RECORDS

OF THE

GEOLOGICAL SURVEY OF VICTORIA

(H. HERMAN, B.C.E., M.M.E., F.G.S., Director).

Vol. III., Part 3.

BRITISH MUSEUM S 22 D NATURAL HISTORY

ISSUED BY

W. DICKSON, SECRETARY FOR MINES, UNDER THE AUTHORITY OF THE HON. J. DRYSDALE BROWN, M.L.C., MINISTER OF MINES.

By Authority:
ALBERT J. MULLETT, GOVERNMENT PRINTER, MELBOURNE.
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THE NEW WORKING MINERS MINE, CRESWICK.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

This mine is about 1 mile east of the Post-office, Creswick, and the top of the shaft is about 1,760 feet above sea level. The shaft is 400 feet deep and on the east side of a steep gully. The country rocks are Ordovician slates and sandstones, grey and yellow in colour. Just east of the shaft the beds dip east, while in the gully a short distance to the west of it the beds dip west, so that the shaft is sunk close to centre country. A tunnel was driven into the hill (which rises to 200 feet above the shaft mouth) about 3 chains south of the shaft, and apparently quartz spurs were worked in eastern country both in the tunnel and in the east cross-cut from the shaft. The shaft is apparently in fair order but all the plant has been removed. From a former underground manager the following particulars were obtained. In the shaft at 112 feet cross-cuts were extended for 30 feet to the east and 30 feet to the west. At 140 feet a cross-cut was extended east for 50 feet. At 200 feet a cross-cut was extended 50 feet to the east and another 70 feet to the west. At 300 feet a cross-cut was driven east for 100 feet, where a flat make of quartz was worked. At 400 feet a cross-cut was driven east for 100 feet and west for 100 feet, and quartz veins were cut and worked in the east cross-cut. Particulars as to yields of quartz and of gold were not obtainable, but a considerable amount of profitable work is said to have been done in this mine. The shaft appears to be in a favorable position for prospecting by sinking and cross-cutting for any "legs" or auriferous spurs.

[29.11.07.]

THE SOUTH STAR MINE, BALLARAT WEST.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

This mine is situate about 2 miles south of Ballarat on the Sebastopol Plateau, and is one of a group working the western lines of reef.

There are three lines of lodes, known as the Consols, the Guiding Star, and the Albion (the most western); they strike in a north and south direction and conform to the strike and dip of the beds of Ordovician sandstones and slates that form the country rock.

Each of these lodes consists of quartz in black slate, and the result of the geological survey being carried out by Mr. Baragwanath goes to prove that the three lodes are on the same band of black slates intercalated with slates and sandstones of grey colour with a total thickness of about 100 feet, and with three or four thin seams of the black slate ranging from 1 inch to 3 inches wide through it. It is the lowest of the black slates or the bed on which the Consols lode was worked that is the productive indicator in this mine.

The whole of the Ordovician slates and sandstones are bent over into a series of anticlines and synclines in Ballarat West, but unlike the Bendigo beds, which form well-arched folds, the Ballarat West beds are bent into a series of acute-angled folds as shown on the accompanying section, Pl. XLII.

Conforming to all these sharp bends is the band of black slates, and in this band and on the bottom slate bed the quartz veins that have yielded such great wealth in gold have formed.

At the apex of the anticlines there are no saddle reefs such as form at Bendigo, but the lodes occurring on the east and west of the anticlines correspond to the "legs" at Bendigo. So far as experience has been gained in mining on these lines of reef, it appears that only the *west* "legs" or the lodes on the *west* side of the anticlines are productive of gold, and all the rich returns have been obtained on the *west* "legs." In this respect the conditions are exactly the opposite of what prevail at Bendigo and Castlemaine where the *east* side of the anticlines is most favorable for the occurrence of gold.

In the case of the western lodes the same bed of black slate with quartz that is highly auriferous on the west side of the anticline is barren on the east side.

The pitch of the Consols shoot is southward; at the New Kohinoor mine this shoot comes up near the surface of the bed rock (about 250 feet below the present surface), but $1\frac{3}{4}$ miles further south, at the South Star mine, the deepest part of the syncline of the black slates and the Consols lode is about 3,500 feet from the present surface. From the New Kohinoor mine southward the Consols shoot of gold has been extensively worked up to the South Star mine.

Workings.

The accompanying section, prepared by Mr. W. Baragwanath, shows the geological structure and workings as surveyed by him.

The shaft is sunk to a depth of 3,170 feet. At 720 feet a western cross-cut is extended for 1,230 feet, and from near the end of this a blind shaft is sunk to the 1,010-ft. level. A fault dipping west cuts through this shaft, and where it intersects the west "leg" or lode the quartz was richly auriferous. This shoot was worked from the 720-ft level to the 1,010-ft. level and for about 900 feet in length, and is said to have yielded 100,000 oz. of gold worth over £400,000. From other parts of the mine £200.000 worth of gold has been won. The shoot above mentioned is on the Guiding Star line. At the 1,400-ft level a cross-cut has been driven west for 1,700 feet; before this cross-cut could intersect the black slate band again it would have to be driven a further distance of 1,300 feet, or altogether 3,000 feet from the shaft to the Albion lode. It therefore becomes a question whether it would not be better to sink another shaft which would command ground still further to the west.

The Albion lode is within the South Star lease, but has not been worked in this lease. In the mine adjoining on the north (the Star of the East mine) the Albion lode has been worked extensively.

In the South Star mine the Consols lode is to the east of the shaft, and several cross-cuts have been driven east to intersect it. Of these the 2,500-ft. cross-cut has been carried further in to the east (some 500 feet or more beyond the Consols lode). In the 2,750-ft., the 3,100-ft., and the 3,170-ft. levels, cross-cuts have been driven to the Consols lode, which is near the shaft, but with results that are not favorable; there is about 4 feet of quartz, but little or no gold.

To reach the bottom of the Consols lode at the shaft would necessitate the sinking of it for another 400 feet, and this may be desirable in order to test the Consols lode at the syncline. Beyond what was proved in the east cross-cut at the 2,500-ft. level, the whole belt of country (about $\frac{3}{4}$ mile across) between the shaft and the Ballarat East belt of indicators is unknown and should be explored.

SKETCH
TRANSVERSE SECTION
OF THE
SOUTH STAR MINE
SEBASTOPOL PLATEAU

Scale, 400 feet to 1 inch.

Anticline A Syncline S

NOTE - The Lode on the Indicator is only auriferous when the dip is to the West

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From the Guiding Star rich shoot of gold just below the 720-ft. level the black slate band rises to the surface of the bed-rock; the great anticline to the west of the shaft has been worn down by denudation, and the gold so derived has gone to enrich the alluvial gravels that have been so extensively worked over the bed-rock of the Sebastopol Plateau.

Water.

The South Star mine, like all the others on the Sebastopol Plateau, has to grapple with a serious water difficulty, for the top of the bed-rock in which the lodes occur is from 300 feet to 400 feet below the present surface, and resting on this bed-rock are gravels, sand, clay and basalt for the above thickness.

Extensive alluvial mining has removed the gravels, and the whole of the alluvial beds are water-logged; the result is that the water under high pressure is forced into the underlying slate and sandstone beds, and mining for quartz reefs in these beds entails heavy expenditure in pumping from the bottom of the shafts water which gets into the workings from the overlying alluvial deposits. In some cases nearly one-half of the total expenditure is for pumping water. The whole group of mines on the Plateau is troubled with this expense, and the total amount spent for this purpose amounts to a very large sum per annum. The question arises whether some co-operative method of dealing with the water—perhaps on the plan adopted at the Thames, New Zealand—could not be adopted to lighten the burden.

At the Thames there is one big pump, and all the mines are connected with it. Each company benefited is assessed for its share of the cost, and the Government subsidizes the pump to the extent of £1 for £1 contributed by the mining companies.

Two salient features have to be recognised, the mining problem and the water problem. The latter should be first dealt with, so as to minimise the costs of mining.

As regards the mining problem there is the whole of the country between the Consols lode and the Ballarat East indicators to be explored, as well as the deeper beds below the black band, also the whole of the country to the west of the Albion lode. The work so far accomplished by the Geological Survey has rendered it possible to understand the conditions under which these western lodes occur, but still further research is needed before the whole problem will be solved.

[*22.7.08*]

THE BRITANNIA UNITED MINE, BALLARAT EAST.

By W. Baragwanath.

The mine is situated on the southern side of Victoria-street, Ballarat East, and comprises an area of nearly 70 acres, held under lease from the Crown. North of the property, the Victoria United Company has its mine workings, while to the south are the Last Chance United Company and a line of workings which extends over a distance of 4 miles and includes the Llanberris, Speedwell, North Normanby, New Normanby, North Woah Hawp, Woah Hawp Canton, and several other mines.

The detailed plans of this mine will be published in the Memoir on Ballarat.*

* Now being prepared for publication. 14.7.14.

The Britannia main shaft is located on the southern side of Barkly-street, overlooking the steep bank of Specimen Vale, a tributary creek of the Yarrowee. The shaft is sunk to a depth of 1,060 feet, with levels opened out west at 1,040 feet, 940 feet, 830 feet and 720 feet below the surface. These levels comprise the main workings at present open, but a short cross-cut was put out west at the 630-ft. level, while to the east old cross-cuts occur at the 560-ft., 500-ft. and 400-ft. levels. At the 720-ft. level, an east cross-cut had reached a point 100 feet east of the shaft twenty years ago and was then abandoned, but has recently been extended.

To enable a correct idea to be formed of this mine or any other in Ballarat East, it is necessary that the structure of the field be grasped. As a result of the present survey, which has extended over several years, it has been found that the gold-field of Ballarat East consists of a series of slate and sandstone beds, probably of Ordovician age, acutely folded into a series of anticlines and synclines. Certain beds have been distinguished by the miners on account of the richness of the quartz veins crossing them, such as the Duchess, Twelve-foot, Four-foot, Seven-foot, &c., among the slates, and the Big Sandstone, the Grit, the Grindstone, &c., among the sandstones. Mineralized seams on which exceptionally large pieces of gold have been found are known as indicators, of which there are several, as The Indicator, the Western Indicator, the Eastern Indicator, the Black Seam, the Pencil Mark, the Telegraph, &c. Along certain bedding planes occur faults or slips (slides); these are locally known as "piths," and are utilized in identifying various slates.

As the result of careful survey and inspection and examination of the whole of the available workings on the Ballarat East gold-field, I have found that the auriferous portion of the field is confined to *eastern* dipping beds. So far, the width of the proved auriferous country is about 350 feet; folds occur on both sides of this, but evidence is gradually accumulating which shows that these barren belts on either side of the auriferous belt are confined to the western dipping strata, and that after a repetition of the folding the strata dip east again, and the auriferous nature of the beds is again apparent. The result of this is that instead of the gold being limited to one belt of 350 feet in width, a similar belt may be expected to the east, probably at a slightly greater depth, while the western belt at about the same level will be found to traverse the whole length of the field.

The quartz formations of Ballarat East may be classed under the following heads:—(*a*) those associated with the "leather-jacket" faults; (*b*) those associated with the anticlines; (*c*) those associated with vertical slides; and (*d*) irregular spurs and veins throughout the whole field.

Of the quartz formations, those of type (*a*) are by far the largest, and, as they occur at intervals, may be dealt with first. The leather-jackets are large faults with a general north and south strike, and they hade westwards at about 45°. They occur throughout all the mines in Ballarat East, and have produced enormous bodies of profitable stone. In width the stone on the footwall varies from a few inches up to 40 feet and more, with large veins going out into the adjacent strata. The leather-jackets occur about 300 feet apart, and I have found that at the depth where one leather-jacket is just entering the barren beds another will be found entering the favorable zone. With a shaft in a well selected site this means that a constant supply of stone can be maintained from close to the shaft, while the leather-jackets in the barren country have dipped away from the shaft.

On formations of type (*b*) very little systematic work has been done of late years, but among former workings the Roberts lode of the Old Llanberris Company provided stone for crushing for twenty years above the 400-ft. level, and this from formations closely associated with the anticline.* Adjoining the Roberts lode workings on the north is the First Chance mine, and in this claim veins, &c., on the anticline and east of it have been exploited to a depth of 700 feet, paying dividends of over £8,000 from a small tribute block. The Britannia United mine lies north-east of the First Chance, but a large cross-course near the boundary brings this same anticline into the Britannia United lease, and on this fold was worked Dunn's lode, clearly a formation analogous to a saddle reef.

The reefs associated with vertical slides, type (*c*), are numerous; they are invariably poor in gold, but veins and spurs crossing them are generally good, hence the verticals are used as guides on which to rise in order to pick up the auriferous veins.

The formations classified as type (*d*), irregular spurs and veins, are to be found throughout the whole field, and occur as a necessary consequence of the twisting, faulting, &c., to which the field has been subjected. In places the veins are small and widely separated, in others they form stockworks, the whole of which pay for extraction and treatment. The indicator veins belong to this class, and vary considerably in size, at times veins under half-an-inch in thickness paying for extraction on The Indicator.

Having reviewed the general structure of the field, it is only necessary to enumerate the main points in connexion with the mine under notice. The Britannia United shaft is sunk to its present depth in east-dipping strata, but at the bottom level the syncline, which has a westerly inclination, lies close to the shaft. The syncline also shows east of the shaft at the 720-ft. level. West of the syncline the favorable belt extends to Dunn's lode, about 300 feet west of the shaft. A large leather-jacket, carrying a decomposed felsite dyke on the footwall with large bodies of solid stone and spurs, passed through the shaft at 560 feet from the surface, and has been worked to the present deepest level at 1,040 feet, but by no means exhausted.

Only one series of centre country formations has as yet been worked, *i.e.*, Dunn's lode at the 720-ft. level; until quite recently between that point and the surface the quartz bodies on the anticline were left intact. During the last six months a rise on the anticline proved large bodies of stone to exist to the east, and one of these is now being worked with payable results about 50 feet above the 720-ft. level. This formation is exposed from 20 to 30 feet in width, with a thickness of from 2 to 5 feet, and has been followed for close on 150 feet. That other similar makes occur cannot be doubted, as the whole of the First Chance workings (to the south-west of the Britannia) lie east of the anticline and between the 700-ft. level and surface. The eastern cross-cut at the 720-ft. level, which was restarted on the advice of the Survey, proved a payable make of stone to exist in the cross-cut almost immediately after passing the eastern anticline. This cross-cut is now being extended in country of highly favorable character, and the discovery of stone in this direction increases the extent of the whole field.

Veins crossing The Indicator were confined to the shallow levels, as The Indicator was not worked below its intersection by the leather-jacket.

Comprised within the company's lease is the old Sulieman Pasha shaft, from which over £250,000 worth of gold was won. From information obtained I find that the lode there worked was of the leather-jacket type.

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* Lidgey. Report on the Ballarat East portion of the Ballarat Gold-field. Spec. Rept. Geol. Surv. Vict., 1894, p. 17.

and carried a decomposed dyke. This lode was very rich in the favorable zone, but since the relation of the auriferous lodes to the structure of the country was not recognised when it was worked, failure to find the continuation of the rich stone, and neglect to prospect for another formation, led to the mine being closed down. To the south, the North First Chance and the First Chance mines are working the Sulieman Lode above the 600-ft. levels.

The Victoria United mine, which adjoins on the north, proved a large body of payable stone on the eastern anticline at a depth of 1,300 feet. This lies about 50 feet west of the Victoria shaft, and the continuation of this make of stone should be found if the Britannia shaft be deepened.

With the shaft put in good order and sunk a further depth of, say, 300 feet, and cross-cuts opened out east and west at each 100 feet, the mine could maintain a large output of stone; while above the 720-ft. level payable makes of stone will be found both east and west of the shaft, always providing that work is carried on in the right direction as laid out above.

The mine is well equipped with a suitable plant consisting of winding engine, pumping engine with pumps to the 1,040-ft. level, air compressor, Roots blower, five boilers, and 40-head battery with condensing engine. A small expenditure on the foundations of the plant would put the whole in good working order; as a matter of fact, it is all working now, but the foundations have given way in places owing to decay and settlement.

In conclusion, it may be added that from the area held, the yield from quartz—exclusive of alluvial—to a depth of 1,000 feet has been close upon £700,000, and this by no means implies that the ground is worked out to that depth.

[*14.3.10.*]

THE PROGRESS OF THE GEOLOGICAL SURVEY AT BALLARAT.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The underground and surface survey now being carried out by Mr. Baragwanath, junior, and his staff, at Ballarat, is making good progress, and the results will be of great value in the future development of gold mining there.

Plans and sections of most of the Sebastopol Plateau mines are in course of preparation, and the one prominent feature they disclose is that a vast sum of money has been uselessly spent in cross-cutting and driving levels in unproductive country.

Profitable mining is only possible in the productive zone of country, and it is not until this is realized that the amount of waste that has taken place through mining in barren and utterly hopeless beds becomes apparent. The surveys clearly define the productive zone and show its relation to the anticlines and synclines, and they will help to prevent similar waste in the future.

Both east and west of the tract of country that has been mined on the Plateau are belts of country so far untried, but which offer promising fields for prospecting. North of the Kohinoor mine the country is only just being opened up, and there is reason to expect favorable results when the northward extension of the richly auriferous zone of the Plateau can be traced.

At Ballarat East the relations of the productive zones to the anticlines have been worked out most successfully, and it is now possible, in the surveyed portions, to decide upon the best way of searching for further productive country. In the First Chance mine, Mr. Baragwanath has been able to indicate in which direction mining should be carried on, and the actual mining results have fully justified his forecasts. An excellent example of a typical saddle reef, with characteristic centre country, has been exposed in No. 5 level, and the ground to the east of this has been profitably worked, and much gold taken from the spurs. A considerable extent of favorable country, lying east of the anticline, awaits development in this mine.

Both east and west of the belt of country already worked so profitably at Ballarat East there are tracts of untouched but promising country that stretch away for many miles and that deserve to be vigorously explored. Northward from Black Hill to Creswick, the northern extension of the phenomenally rich auriferous lodes has still to be traced. Southward from present workings there is also a great field for prospecting.

With the knowledge of the structure of the rocks on this field and the manner in which gold is distributed so far acquired through the Survey, the outlook for gold-mining has greatly expanded and the gold resources in reserve have become more apparent.

Altogether the result of the work so far accomplished points to the existence of tracts of country that are probably auriferous and even more extensive than the areas that have so far been worked. By means of the data Mr. Baragwanath has accumulated, most valuable and reliable guidance can be given in all future mining operations, and the present feeling of distrust in some of the centres of mining enterprises may be dissipated. There is ample room on this field for a large expansion of the industry.

[*28.1.10.*]

PROSPECTING OPERATIONS NEAR THE CEMETERY, BALLARAT.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

When the alluvial mining was at its height, gutters were worked and rich returns in gold obtained a little south of the cemetery, at the intersection of Hotham and Mills streets. There is half an acre of ground belonging to the syndicate, with a shaft upon it, and there is from ½ to 1 acre more adjacent, which is private land but is not built upon, and which might be arranged for. In fact, except at this site, the ground all about is thickly built over. The site is in an area that has not, so far, been prospected for reefs.

There is bed-rock (Ordovician slates and sandstones) cropping out at the cemetery, and in sinking graves there richly auriferous quartz has been obtained. This bed-rock dips underfoot, going southward towards the proposed site, and at the site the shaft disclosed in the section 100 feet of basalt, then a few feet of Tertiary clay, and below that slates and sandstones in a decomposed condition (pipeclay in part).

The shaft is 180 feet deep, and two levels have been driven from it, one at 140 feet in a northerly direction; this was extended until it broke into the alluvial gutter. At 175 feet another level was extended in a north-easterly direction until the gutter was driven into. It does not

appear quite clear what amount of water was encountered in the lower drive, but at present the water stands at between 50 and 60 feet from the sill of the shaft.

It will be a great saving if this shaft on the Great Ballarat West mine can be used. Work was discontinued about nine years ago, and the timbers are supposed to be quite sound. The one point is to discover by baling whether there is any strong inflow from the bottom level. If the ground has swelled in the bottom level since it was filled with water, it may have completely closed up the drive and in this way dammed back the water. Should the result of baling show that there is little water coming in from the drives, then dams might be built in the drives, and the shaft could be sunk, say, to not less than 500 feet before opening out crosscuts east and west.

On the plan of the mine on which the shaft is, a reef known as the Emerald is shown. It runs to the east of the shaft and, according to the sketch section, the shaft should cut the course of this reef at about 600 feet in depth. Whether this reef would be cut or not, the work done would enable the structure of the rocks at this site to be made out, which could not otherwise be done, as the slates and sandstones are concealed below 100 feet or more of basalt. The belt of country in which the proposed site is situated consists of favorable-looking beds, and from the upper portion of these beds the alluvial gutters were fed. In the same belt, but further to the north, and on the northern boundary of the Cemetery, Chamber's Syndicate are opening out at a depth of 50 feet from the surface, and they have crushed some quartz that gave 15 dwt. of gold per ton. The quartz occurs as spurs through soft, white, slaty beds (pipeclay). The gold is coarse and of high quality, worth £4 3s. per oz.

The proposed site would test a tract of country that has not yet been prospected for quartz reefs and a tract from which rich alluvial gold was won. If this ground is opened up it would certainly furnish valuable data that could not otherwise be obtained.

The nearest quartz mine to the south is the Kohinoor mine, about a mile distant. Should baling the water prove to be heavy, it would be better to sink another shaft close by than to have to pump perpetually from the reserves of water stored in the alluvial ground.

For prospecting purposes I consider the site suggested the best that can be obtained, and that unless some work is done to explore this belt of country, nothing more will ever be known of its value. But there is no well-defined line of reef to sink for, and whatever work is done will be in search of auriferous quartz that is not actually located; the country rock is, however, such that auriferous quartz may be expected to occur in it.

[*16.1.08.*]

THE WOAH HAWP CENTRAL MINE, BALLARAT EAST.

By W. Baragwanath.

The Woah Hawp Central Company's claim is situated at Ballarat East, southern extension. Work at the claim is confined to a line of fault which intersects the strata at a high angle. The strata dip easterly at from 60° to 80°, while the fault dips westerly at an angle of 60°. A rise has been put up on this fault about 100 feet and connected with a vertical air-shaft. About 130 feet below the surface a short drive north shows about 6 inches of white quartz on the fault plane. At the foot of the air-shaft the quartz on the fault appears to be about 1 foot wide.

At the level of the main crosscut a drive was put in south along the fault, and at 90 feet from the crosscut a rise put up. Very little quartz was to be seen in this rise.

From the result of my examination, I am of the opinion that the quartz is better developed in the shallow levels. The pitch of the stone appears to be southerly, so that any makes of stone should be met with on the surface further north.

Prospecting at a shallow level by means of a windlass or whip-shaft would prove any shoots that may exist, and this work could be cheaply carried out as compared with the method now to be adopted of putting all quartz and mullock down a long shoot to be trucked about 400 feet and hauled 200 feet to the surface.

From a geological point of view, the mine is well situated, but the line of fault along which operations are now confined does not appear to have been much worked. Hanthorn, in 1887, obtained about 600 oz. of gold from a shaft about 1,000 feet north, but further particulars are not available. From the appearance of the stone where visible in the rise, it would seem that two conditions are necessary for the occurrence of a shoot—the formation of a vein of quartz, and the intersection of that vein with a favorable belt of slate or sandstone. As the belts of strata are, for the most part, very narrow, such shoots will be consequently narrow, and as the angle of dip is fairly flat, economical working does not appear easy. A crushing is at present being got out from the rise workings, where the stone is thought to be payable. This make might be tested, but the better plan to adopt. if this line is to be developed, is to drive south at the main level and intersect any makes of stone on their southerly pitch. To discover auriferous shoots in these formations will then be another matter.

To date, a sum of £3,785 capital has been expended, together with £425 for gold from trial crushings. A main shaft has been sunk 200 feet, and a total of 1,011 feet of crosscuts, 636 feet of driving, 350 feet of rising, carried out. This does not include stope workings.

[27.2.08.]

THE BIRTHDAY MINE, BERRINGA, NEAR SCARSDALE.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The shaft of the Birthday Mine is 1,270 feet deep. At No. 6 level, which is 550 feet from surface, centre country occurs in the west cross-cut at 270 feet from the shaft. The channel of the Birthday reef occurs at 90 feet from the shaft in this cross-cut; the lode channel is vertical, and the level has been driven along it north for 90 feet and south for 75 feet.

At No. 10 level the extreme distance driven south from the cross-cut is 680 feet, and at 613 feet a winze has been sunk 42 feet. There is a good hanging-wall in the bottom of the winze dipping 78° W., and the reef is 3 feet thick. There is 6 inches of grey slate on the hanging-wall, and then grey sandstone. Stoping has been done above the No. 10 level, and it appears as though the bottom of the shoot of gold was passed through in the winze a few feet below No. 10 level, for quartz carrying a few dwt. of gold was crushed from the upper part of the winze, while the quartz at the bottom of the winze is extremely poor. No advantage is to be gained as far as prospecting is concerned by continuing the winze, but it would be useful for ventilating purposes. The proper course here would be to sink the winze and then drive south, say,

100 feet below the level, but this cannot be done because there is water in the bottom levels of the mine to the south and close to where the winze is placed. The lease adjoining the Birthday to the south has been acquired by that company. The shoots at Berringa, south of the Tunnel mine, pitch southward.

The bottom level (No. 12) is 1,270 feet below the surface. In the west cross-cut at 30 feet from the shaft centre country is passed through, and west-dipping beds are then cut. At 101 feet west from the shaft is a fault dipping west. At 155 feet from the shaft a quartz reef occurs dipping west at 54°. The footwall is smooth, and the quartz reef is 21 feet thick and well laminated. A level has been driven northward on this reef for 240 feet. At the north end of the level the reef is 5 feet thick, and it dips 71° to the west. Southward a level has been driven for 608 feet from the cross-cut along the lode. The footwall is smooth, and dips 76° to the west. Faults have disturbed, displaced, and crushed the reef along this level. At 460 feet from the cross-cut in the south level, a cross-cut has been driven west through the reef for 36 feet. In this cross-cut there is a fault dipping east that shows at several points on the west side of the reef; at this level it occurs on a bed of black slate; in No. 10 level it shows at 110 feet west of the shaft in the west cross-cut; and in No. 12 level it is seen in the west cross-cut at 180 feet from the shaft. West of the quartz lode the country dips east. At the south end of the cross-cut in the No. 12 (bottom) level the reef in the face is only a few inches thick. This is no doubt the Birthday reef. At this level in the east cross-cut at 30 feet from the shaft there is a syncline, but this must be a minor fold; from the syncline to the end of the cross-cut the beds dip west. The country rock consists of thick beds of slate and sandstone.

In the present condition of the mine it would be advisable to drive northward at the No. 10 level, and southward from the end of the bottom level (No. 12); the former to meet any new shoots that may exist, the latter to cut at the No. 12 level the old shoot worked at higher levels. The deepening of the shaft is also of great importance, and will be of permanent benefit, as this mine is only at the beginning of its career. When the shaft is deepened an east cross-cut should be driven so as to cut the zone of country in which the large saddle reefs occur at the Tunnel mine.

[*14.5.09.*]

THORNTON'S REWARD MINE, BERRINGA.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

This mine is situate about 3 miles from Berringa in a direction about S. 30° W. from the town. It is on the west bank of Moonlight Creek, and from this mine alluvial gold workings extend down the creek. Apparently the gold was, at any rate in part, derived from the reef now being worked. The main shaft is 112 feet deep, and from the bottom a cross-cut is driven east 171 feet through slate and sandstone. The country dips east for 140 feet from the shaft and then changes and dips west; the change is due to a fault, and there is not a synclinal arch. Quartz veins were cut at several sites, and the country is very much broken. At 40 feet from the shaft, the cross-cut passes through the fault that moved the reef 12 feet a little south of the winze. A level south from the east cross-cut is extended for over 150 feet, and in the bottom near the face

rich pyrites occurs. The outcrop of the reef was discovered on the east bank of the creek, and a small shaft was sunk 40 feet deep. In it the shoot of auriferous quartz was struck at 12 feet from the surface. The strike of the reef is N. 5° E.; dip, 85° W.; pitch of auriferous shoot, 25° S.; strike of the country rock, N. 17° E.; dip, 60° E. Yellow sandstone with quartz spurs occurs at the north end of the shoot. The reef where first struck was 3 inches thick, but it expanded to 3 feet lower down. The shoot was followed southward for 230 feet. At a depth of 45 feet from the surface a fault dipping east at a low angle displaced the reef 4 feet to the west, going south. Above the fault the quartz was worth about 10 dwt. of gold per ton, but below the value decreased to 5½ dwt. At 172 feet south of the small shaft another shoot of quartz came in and yielded 6 dwt. of gold per ton. The reef was 12 inches thick. At 230 feet southerly from the small shaft a cross fault dipping south-easterly at 60° cuts everything off. This appears to be a strong fault, and the reef has to be searched for on the south side of it. At 130 feet south of the small shaft in the level, and 60 feet below the surface, a winze has been sunk 48 feet, which connects with the workings from the main shaft. In the main shaft level, 112 feet deep and just under the winze from the 60-ft. intermediate level, the reef is 2 feet thick and poor in gold. A fault at 20 feet south from the bottom of the winze moved the lode 12 feet east, going south. The pitch of the shoot is about 20° S. At 52 feet south of the winze a new shoot of quartz comes in overhead; it carries about 2 dwt. of gold per ton, and widens out to 6 feet thick. The dip of the reef is 59° W.; this is probably the normal dip. At 121 feet south of the winze the bottom level ends and the fault must be within a few feet of the face, and this will again cut everything off. A drive along the fault in a south-westerly direction should be made to pick up the lode again. Twelve feet back from the face of the end of the bottom level, fine-grained iron pyrites occurs in the lode on the floor of the drive. A sample taken in my presence assayed at the laboratory 6 oz. 17 dwt. 20 gr. of gold per ton of ore, and the mineral and quartz were 12 inches thick. A winze should be sunk on this rich ore. The shaft at this mine should be sunk another 100 feet, and the lode would be cut at no great distance from the shaft. From the appearance of the adjacent country it is likely that other auriferous reefs exist. High-level auriferous gravels have been worked close by, and the recent alluvium along Moonlight Creek has been extensively worked. There is no better immediate work to be done than the following up of the rich gold-bearing pyrites near the south face of the bottom level, and the material from this work should pay handsomely. Nine hundred and ten tons of quartz has been crushed for 267 oz. 2 dwt. of gold.

[13.5.09.]

MARINE AURIFEROUS DRIFTS, ILLIBAROOK, NEAR ROKEWOOD.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

Between Thornton's Reward mine and Illibarook the country consists of Tertiary beds, and these have been worked at many sites for alluvial gold. Quite close to Thornton's Reward mine, on Moonlight Creek, and about ½ mile in a southerly direction on the top of the rise, an old lead has been worked. This may have been where a stream flowed

into an estuary, for the quartz pebbles are very well rounded and many of them ground very small. They bear evidence of sea action, and not of river action. In the sea along the shore the pebbles would be subjected to constant wear by the waves and tides and by currents; the result has been the production of extremely well-rounded, generally small, and unusually white, quartz pebbles. In places they are bound together by clay or limonite into a conglomerate. There is a marked resemblance between these pebbles and conglomerates and such as are found at Studley Park, near Melbourne, where they are also probably of marine origin. The old auriferous leads have a definite course until they reach the shore-line, but along the old coast the gravels are dispersed irregularly.

A peculiar feature in connexion with the auriferous alluvial workings over this area and as far back as Berringa, is the "crevice mining," which has been extensively carried on. The bedrock is decomposed Ordovician sandstones and slates, the latter altered and bleached and forming what is called a pipeclay bottom. Apparently through the action of currents or tides, crevices have been washed out of the bedrock, generally in the direction of the strike of the beds, but not uncommonly also across the strike at varying angles. These crevices range from less than 1 inch in width to 2 or 3 feet wide. In length they are sometimes more than 100 feet, and in depth they range from a few inches to 20 feet. Into these crevices sand and pebbles together with both fine and coarse gold have found their way and ultimately quite filled them up. It is commonly the case that in the gravel on the bedrock there is very little gold present, not enough to pay for working, but in the crevices rich returns were obtained. The method of mining for these crevices is to drive through the pipeclay and soft sandstone bedrock until the gritty seam of gravel filling the crevice is intersected; it is then followed up, and the gravel from it washed to secure the gold present.

A more distinct and direct proof that the sea beach at one time existed near Illibarook in Tertiary times is the presence of holes made by boring molluscs, such as Pholas, in the slaty bedrock. They are common in the vicinity. Sharks' teeth are also reported to have been found in the wash-dirt in the neighbourhood. Near Pitfield the bores have proved that marine shells of Tertiary age are present beneath the basalt.

It then appears that in Tertiary times sea beaches existed to the foot of the hills or as far as Berringa, and that these beaches have receded, no doubt through the rising of the land, until now the shore-line is 50 miles away and the old beaches are over 600 feet above present sea level. This indicates vast changes extending over a lengthened period of time.

At Pitfield it has been found that the slimes from some of the alluvial workings are rich in gold, and they have been cyanided extensively; the slimes from the Union mine are reported exceptionally rich. As the ancient streams that brought down the auriferous gravels debouched into the sea a little further south, and as the fine gold of the slimes was no doubt carried on to the beach in great quantities by the streams and there probably concentrated by the waves and tides, it is a matter for consideration whether there may not exist beach deposits of very fine gold similar to what occurred on the west coast of the South Island of New Zealand and yielded vast quantities of gold.

It will probably be found when the gold won from the residues from the mines is added to the yields obtained in working them, that the leads actually contained enough gold to give splendid returns, but that a large proportion has been lost to the original workers through a wasteful and primitive method of gold saving.

Some careful boring may be needed to search for gold-bearing silts and beach sands. This would apply not only to the older Tertiary high level marine deposits, but also to the later deposits continuous with the Pitfield leads.

About Illibarook itself some of the finer shore deposits could be prospected at a small expense, and if any of these were found worth cyaniding it might be the means of opening up a considerable industry, because they are certain to extend over considerable areas, and the improvements in cyaniding have been so great that the costs can be paid for about ½ dwt. of gold per ton.

[*20.5.09.*]

A VOLCANIC NECK NEAR MEREDITH.

By W. H. Ferguson.

What appears to be a pipe of an ancient volcano is situated about 3 miles east of Meredith and about ½ mile west of the Moorabool River in an allotment marked "84 a. 0 r. 5 p., A. McPherson," on the parish map; this allotment is west of allotment No. 7 of Y, parish of Moreep. The country for the most part consists of Ordovician slates and sandstones, which yield a light, loamy, rather poor soil. On the east side of the river, there is some basalt in allotment No. 5 of Y, parish of Moreep. The soil of the pipe differs remarkably from that of the surrounding rocks, and supplies over an acre of extremely fertile black clayey loam; it is friable, and does not crack much when dry. The land is owned and worked as a garden and orchard by Mr. J. H. Young. The orchard has a gentle slope to a flat gully, and is surrounded by steep ridges of Ordovician rocks. The

FIG. 32.—Sketch plan of Volcanic Neck near Meredith. Scale about 4 chains to 1 inch.

rock which filled the pipe is quite decomposed at the surface. Scattered over the orchard are numerous pieces of hornblende varying from the size of grains of wheat up to one piece 4 inches in diameter, which was presented to the Department by Mr. J. H. Young. Through the soil there is

a quantity of dark mica in flakes up to ½ inch in diameter. There are numerous fragments of slate, which have apparently been in the pipe and have been rendered somewhat flinty in character. In the orchard there was found a small piece of very cellular siliceous stone which may be a form of sinter, and hydrothermal action is also suggested by a fragment of chalcedonic quartz, which is arranged with layers of either alumina or hydrated silica. The most interesting piece of stone found is a small fragment of tuff which contains crystals of partly decomposed hornblende, crystals of dark mica, and a fragment of slate.

Mr. Young informs me that a well was sunk to a depth of 23 feet through the strata here mentioned—

11	feet black soil
3	feet black clay
2	feet black volcanic clay
7	feet yellow clay with mica (decomposed tuff)
23	feet.

This hole was sunk in the gully only a few feet from the Ordovician rock. Concentrates from a dish of surface soil contain a few small pieces of what appear to be garnet. The soil grows fruit trees well, and fine crops of potatoes, onions, and maize.

This pipe resembles in many respects the one at Point Kruger, near Cape Paterson; it is probably the lower portion of one of the volcanoes of Older Volcanic age, and from it may have come some of the Older Volcanic lava which is shown on the Maude quarter-sheet.

[*6.12.09.*]

SAND SUITABLE FOR GLASS-MAKING, DOG TRAP GULLY, NEAR BACCHUS MARSH.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

At Dog Trap Gully, near Bacchus Marsh, 100 feet of alternating beds of fine white clay, clay with sand, coarse sand, and extremely fine sand, are exposed in a cutting. The beds range from a few feet to many feet in thickness.

The bed of very fine sand appeared suitable for glass-making, and some was sent to Messrs. Knott Bros. to test. They made glass from it, and expressed a favorable opinion on it.

As taken from the seam this sand analyzed in the Departmental Laboratory as under:—

Silica	96.46
Alumina	2.27
Iron Oxide	0.15
	98.88

By agitating the sand in water and decanting the suspended material, a very great improvement in the quality of the sand for glass-making was effected, as the analysis after washing shows, viz. :—

Silica	98.85
Alumina	0.50
Ferric Oxide	0.13
Magnesia	trace
Titanic Oxide	0.37
Loss on ignition	0.13
	99.98

In the process of washing and decanting a loss of 6 per cent. was made, but the quality of the sand was much improved.

The slimes consisted of :—

Silica	90.72
Alumina	7.16
Water	2.12
	100.00

Sand containing 98.85 per cent. of silica should meet the requirements for manufacturing the finer quality of glass, and the attention of those engaged in glass-making might be drawn to the fact that such material occurs in abundance on a railway line and within 40 miles of Melbourne.

[24.4.08.]

LIMESTONE AT TALLENT'S HILL, CURDIE'S RIVER, NEAR TIMBOON, AND AT KAWARREN, NEAR COLAC.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

Tallent's Hill.

Curdie's River, where the railway crosses it, is about 150 feet above sea level. The river-bed consists of calcareous Tertiary strata, and these continue to the highest points of the ridges and bluffs that border the river and rise quite 200 feet above it. The whole of the country bordering the river consists of these calcareous beds.

Some of the beds are earthy in character and could be dug out ; others are of firmer texture, and appear to be of better quality. No sandstones, arenaceous beds, nor any clayey beds were observed in the neighbourhood. There is an unlimited quantity of limestone in the parish of Timboon, but it appears to be all privately owned in the vicinity of the railway.

In view of the enormous demand that must arise in the northern and north-eastern portions of the State for lime for agricultural purposes, this limestone area is an incalculable asset, and should be opened up in an extensive manner and with a view to furnishing the lime at a low cost.

Excellent sites for kilns occur on both sides of the railway from the saw-mills southward, but to decide upon the most favorable site for economical and extensive operations would require exhaustive tests of the limestone in order to determine where it is of the best quality, most abundant, and most accessible.

Before anything is done towards fixing on a site for permanent works, it is desirable that a small kiln should be built close to the railway, and that samples of the limestone from the several localities should be tested as to their suitability for burning into lime.

When it is determined which bands of limestone will yield the best results on burning, then the extent and thicknesss of these bands should be proved, and in this way the best sites for the large kilns can be decided.

The site shown me by Mr. Watt is at Tallent's Hill, and undoubtedly a very large quantity of limestone could be dealt with here. Tallent's Hill is on the south side of Curdie's River, and on the railway line, where a siding has already been made. On the north side of the river and west of the railway, is another site that would command a greater height of limestone, and about 1 mile north of the bridge and on the east side of the line there is a steep limestone slope that rises still higher above the railway and that could be dealt with by means of a short siding. The whole of the spurs and slopes below the basalt plateau, which ends near the saw-mill, consist of calcareous material, but without practical tests the most suitable bands for lime-making cannot be determined.

Fuel is abundant, and the forest round should be conserved with a view to supplying a constant and cheap fuel.

In developing the lime industry, the freight charges will have an important bearing, and the lower the charge the greater will be the expansion. For the wheat-growing and for the irrigation areas lime will soon become indispensable, and the area under notice can supply it in quantities that would meet all requirements.

Limestone crops out as far north as Cobden, but it is apparently not so concentrated, and there are associated beds of clay, sand, &c., with it. It might, however, be worth while to bore into some of the Tertiary beds near Cobden to test the quality of the limestones that may occur below the clays and marls.

Analysis of the limestone from the north face of Tallent's Hill, Curdie's River, shows carbonate of lime 92.61%, insoluble silica 3.54%. and from the east face of Tallent's Hill, close to the railway, the analysis shows carbonate of lime 88.39%, insoluble silica 4.30%. This shows the limestone to range from fairly good to good quality.

The Moorabool limestone, which is extensively burnt for lime at Geelong, is of splendid quality, and contains carbonate of lime 96.00 per cent. For agricultural, and also for building purposes, the Curdie's River lime is most valuable, though it will not go so far as the highest quality of lime.

It is quite possible that an exhaustive examination of this area would disclose the presence of even higher grades of limestone than those analyzed, but it is satisfactory to know that there is abundance equal to the samples tested.

The deposit is now being worked by the Bulldog Lime Co.

Kawarren.

The site of this limestone deposit is 29 chains west from Kawarren railway station, which lies 13 miles southward from Colac. A tramway connects the limestone with the railway.

The whole of the country around consists of Tertiary deposits, apparently of Newer Pliocene age. The prevailing beds consist of arenaceous deposits, that in some cases are ferruginous, with some clay beds, and this limestone occurrence appears to be abnormal and different from the surrounding rocks. There is no other lime outcrop for some miles. On the

eastern side the limestone presents an abrupt face of about 80 feet in height, and it is here the quarries and kilns are situated. Several acres of limestone exist, but as the western extent of the limestone has not been determined it is impossible to say what the total area is. There is certainly a thickness of 80 feet, and the bottom has not been reached. The quarry has a face 80 feet wide.

The limestone consists principally of comminuted fragments of coral, shells, &c., and appears to be entirely composed of organic remains. There is a great variety of shells in fairly perfect condition; the fragments appear to be somewhat rounded. Clay pipes show in the face of the quarry, and as this material is valueless and has to be removed, it is an undesirable feature. There is an overburden of from 2 to 3 feet of soil covering the limestone.

Fuel is abundant, and the lime can be burnt cheaply and delivered at a low cost on to railway trucks. At present, most of the lime burnt in the two kilns is used for building purposes, but the demand in this direction is insufficient to maintain an output that would be profitable. There are great tracts of agricultural land close by and away northward that would greatly benefit by lime dressings, and if the industry of lime-burning is to become a prosperous one this field of consumption must be exploited.

At present, the lime can be delivered into trucks at 1s. 3d. per bag, 18 bags to the ton. If large quantities were required for agriculture, this price could be very much reduced. The occurrence at this site so close to the railway renders it a very valuable one.

On analysis a sample of this limestone showed carbonate of lime 88.02%, insoluble silica 3.48%. This shows the limestone to be of fairly good quality, and quite good enough for agricultural purposes and for building also, although not quite so strong for this latter purpose as the Geelong lime. There is scope for widely extending the industry at this site when the value of lime for agriculture is more fully appreciated.

[*11.3.10.*]

NOTES ON COAL AND COAL BORES IN THE DEAN'S MARSH AND BEECH FOREST DISTRICTS.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

Dean's Marsh.

No. 1 bore, Boonah Parish, is situate near the road from Dean's Marsh to Lorne, and is 7 miles distant from Dean's Marsh. The bore is on a slope a short distance off the main road. It is 220 feet below the crest of the ridge, and 130 feet above the bottom of the valley where the brown coal seam was worked. The top of the bore is 1,140 feet above sea-level. From the surface to 300 feet the beds are Tertiary clays, soft sandstones, &c. At 164 feet a bed of impure lignite, 4 ft. 2 in. thick, was pierced. From 300 feet grey and greenish-grey Jurassic sandstone, bedded at an angle of about 40°, was drilled through for about 150 feet. Below the greenish-grey sandstone, grey and dark-grey sandstones, with abundant films of coaly material, and bedded nearly horizontally, were drilled through to the present depth of 800 feet. There is a general absence of the dark to black shales usually found associated with coal seams in the Jurassic coal measures, and so far as the boring has proceeded the indications are not favorable. The search work now being carried on in the Otway district is purely exploratory, and until further data are accumulated the work of boring can only be conducted on empirical lines.

The deposit of brown coal near this drill site was formerly worked, and some thousands of tons of coal were marketed. The coal is of exceptionally good quality as a brown coal, and the seam when worked ranged from 6 to 12 feet thick, but the extent of the seam appears to be very limited. A tramway 7 miles long was laid down to connect the mine with Dean's Marsh. The rails have been removed from the tram line and the machinery from the mine.

Bore No. 1, Parish of Bambra.

This bore is at a site on the road from Dean's Marsh to Lorne, and 3 miles from Dean's Marsh at 1,000 feet above sea-level.

At this site there is a total absence of the greenish sandstones that were met with at No. 1 Boonah bore. The grey sandstones resemble those in the upper part of the last-named bore, and in them coaly films abound. These films represent vegetation that has been deposited in the form of leaves, stems, &c., of plants, and which have become coal since. The beds are nearly horizontal, and show a considerable amount of false bedding.

Asplin's Coal Seam, Forrest.

From Dean's Marsh to Forrest the rocks are for the most part of Tertiary age, apparently covering Jurassic beds. The flats have a fertile soil, but the hills and rises are of poor quality.

About 6 miles by road in a south-westerly direction from Forrest, on the east portion of Allotment 10, Section A, Parish of Yaugher, is Asplin's coal seam. There is 5 inches of good-looking coal in dark shale and sandstones. The beds are nearly horizontal. A drive has been put in for 30 feet in a south-easterly direction. At the end of the drive the beds and seam began to dip more steeply south-east, and the seam is stated to have thickened to 12 inches. The seam is in the bottom of a gully, and about 751 feet above sea-level. At a short distance from the first drive there is another about 40 feet in length also; both were made by Mr. Asplin. The general aspect here appears to be more favorable for coal than at the sites where boring has been done.

Beech Forest.

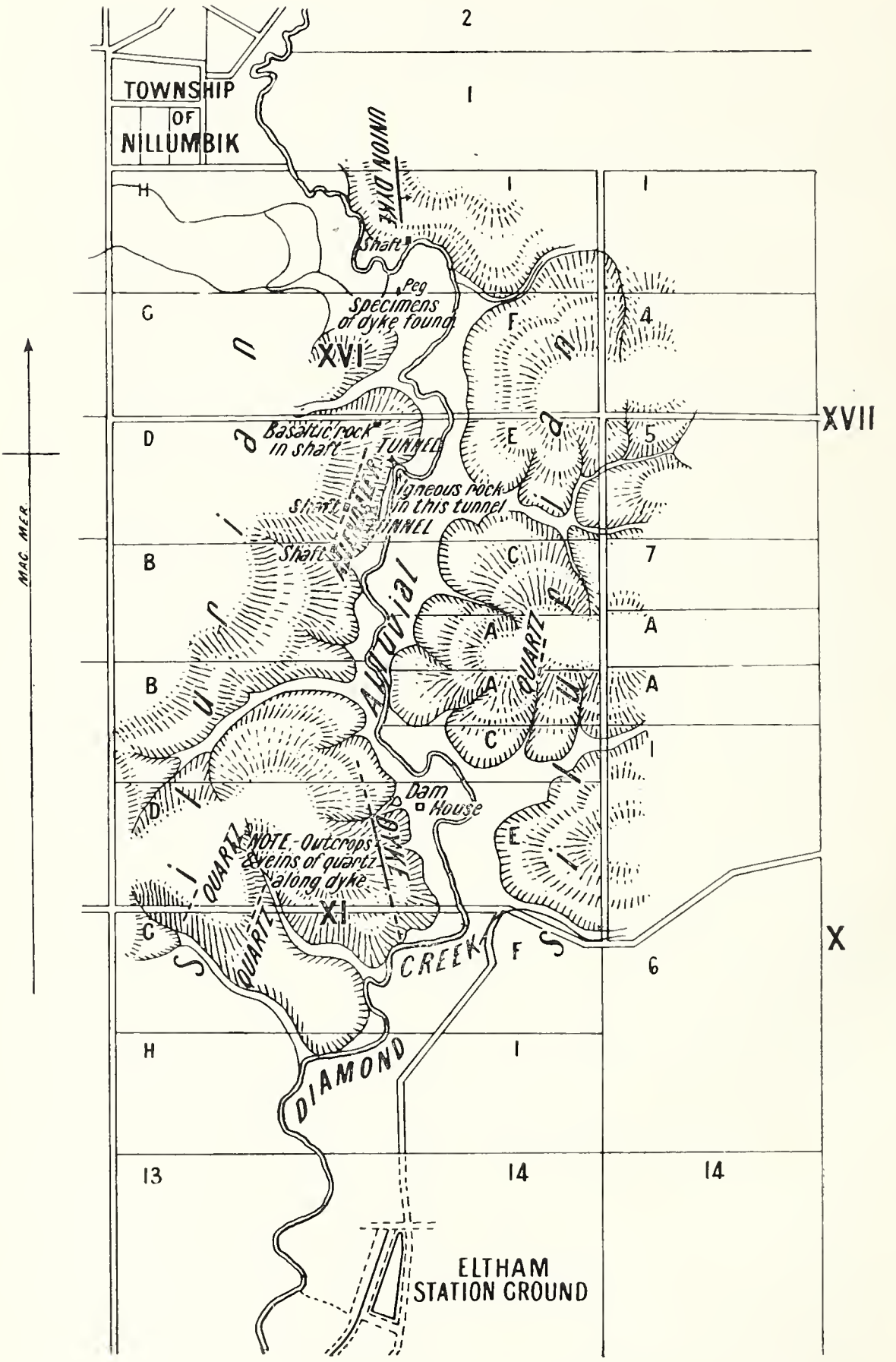
The top of the hill on which the town of Beech Forest is built, 1,950 feet above sea-level, consists of soft, yellowish sandstone that decomposes into a fertile soil. The dip of these beds is towards the south. At the butter factory, near Beech Forest railway station, in excavating a small tank, some coaly material was found associated with shales and sandstones, but no actual seam. About 16 chains north from Ditchley is a quarry, 1,650 feet above sea-level, on Mr. Gardiner's land, where a firm, grey sandstone is being quarried for road-metal. In this quarry, on the west side, there is a layer, about 3 inches thick, of coaly films in the sandstone, representing plant remains, but there is no actual coal seam. The east side of the quarry, where it is stated a thin seam of coal was showing, could not be examined, as it was covered up, but as the rock here is solid sandstone, the coaly matter could not have been of much importance.

It would be advisable to bore the country systematically from where the drill now is, and not to do the work in an erratic manner. Later on this district can be tested when proper data have been accumulated.

At Ditchley quarry the beds appear to be fairly horizontal, but from Wimba northward they have a northerly dip which amounts in some cases to as much as 30° to 40°.

[6.5.08.]

Plate XLIII.



Plan Showing Dykes and Reefs between Eltham and Nillumbik.

Scale, 40 chains to 1 inch.

THE SOUTHERN EXTENSION OF THE DYKE FOUND IN THE UNION MINE, DIAMOND CREEK.

By A. M. Howitt.

The main reef workings in the Diamond Creek district are along a felspathic dyke, as described in a report on the Union mine by Mr. E. J. Dunn, F.G.S., in the *Records of the Geological Survey*, Vol. II, Part I.

At the Union mine the reef and dyke have been worked some distance south of the shaft, and specimens of the dyke rock were found near the old South shaft, close to the south-west corner peg. South of this the dyke has not been definitely traced. A decomposed igneous rock of more basic character than the Union dyke, and probably more recent in age, occurs in an old tunnel about 10 chains north of the Allendale tunnel; and in a shaft a few chains away a basaltic rock was cut, which may have some connexion with that in the tunnel.

Going south through allotment D, Sec. XVI., the Allendale reef is met with; it is one of those reefs locally called a "diagonal," that is, a quartz vein formed along a fault that displaces the dyke. Years ago this reef was mined by a number of shafts ranging from 30 feet to 110 feet deep, and in more recent years by a tunnel 290 feet long and other works.

The strike of the reef is about N. 20° E., and its dip is from westerly to vertical. The strata also strike east of north.

Two ounces of gold to the ton is stated to have been obtained near the surface, but crushings taken out about ten years ago from deeper workings gave the following yields:—

8 tons—18 dwt. per ton.
13 tons—1 oz. per ton.
7 tons—16 dwt. per ton.

The stone, which was laminated and nicely mineralized, averaged about 4 inches wide, reaching a greater thickness as bulges were met. A mineralized body of stone, about 1 foot thick, was mined but not crushed, and several tons of it are now showing on the dump. No dyke was found.

The last shaft on the Allendale line of reef is in allotment B, Sec. XVI. South from this point the main felspathic dyke could not be traced owing to the soil obscuring the underlying rocks, but I am of the opinion that it is not far south of the last Allendale shaft. In allotment B, Sec. XI., the dyke does not outcrop; in allotment D, Sec. XI., it outcrops for some distance but lies to the west of its course when last seen at the surface near the Union mine. The dyke walls cannot be examined from the surface, but from the trend of the outcrops it is probably very wide, underlays to the east, and strikes N. 15° W.

The outcrops and veins of quartz along and adjacent to this southern extension of the main felspathic dyke are worth the attention of prospectors.

From this geological examination it appears that across the Diamond Creek from the Union mine the main Diamond Creek dyke has been faulted to the west, going south, by one or several separate movements; and one of these movements may have been more extensive and possibly along the Allendale reef "diagonal." (See plate XLIII.)

I examined the country to the east of the creek as shown on the plan, but could discover no outcrops of dyke rock on that side.

[*17.7.08.*]

ELLITSON AND PARTY'S CLAIM AT WARRANDYTE.

By D. J. Mahony, M.Sc., F.G.S.

Messrs. Ellitson and party are at work on a dyke formation about one mile north-east of the township of Warrandyte and just to the north of the section marked J. Thompson's pre-emptive right. The claim is situated on top of a ridge which runs north-west towards the Yarra, which is about a quarter of a mile distant. On the top of the ridge, and running in the same direction as it, are two parallel dykes about 100 yards apart. They are hidden by soil except where there have been mining operations, but they can be traced for fully a mile by old workings. I had no time to go further, but the formation is said to have been proved auriferous over a distance of 4½ miles. The rock which the dykes have penetrated is Silurian and consists of sandstones and slates folded into synclines and anticlines which strike about N. 15° E. The beds at the mine dip eastward at a smaller angle than the dyke, which dips in the same direction at about 50° and strikes N. 30° W. The dykes cut across the beds both in dip and strike. The more important and continuous dyke is the western; probably they join underground.

For some distance from the river mining operations of very considerable extent were formerly carried on along the line. The alluvium on the river side has been worked for gold evidently derived from the dyke, and the dyke itself has been followed by tunnels and shafts. The subsidence of the surface along the line indicates that a large quantity of material has been removed from below, and the extent of the operations shows that the results obtained must have been payable. Forbes (Progress Report No. IX., 1898, page 47) says that "the dyke has been worked over 100 feet on the underlie from the top of the hill towards the river for a yield of 5 dwt. per ton. A smaller dyke to the east gave 2½ dwt. per ton. . . . 1,500 tons crushed locally averaged 2¾ to 3 dwt. per ton." Alluvial gold has been worked in the gullies on both sides of the ridge and at the present time a number of men are at work on the small creek close to the main coach road to Ringwood (Sec. 3, Parish of Warrandyte).

Ellitson and party are making use of an old shaft and drive said to have been made over 20 years ago. The ground stands well and does not require timbering. The shaft is 120 feet deep and is situated about 160 feet to the east of the main or western dyke, which dips towards it. From the bottom a crosscut intersects the dyke at 80 feet from the shaft. Drives have been made to follow the dyke north and south but at the time of my visit the northern drive was blocked up. The southern drive is about 70 feet in length and has a bearing of N. 20° W. The dyke varies from 4ft. 9in. to 5ft. 9in. in width; the walls are well defined and slickensided in places. The dyke material is soft and felspathic and very easily broken out; it is greyish white in colour and full of little cubes of pyrites and leaders of secondary quartz. The quartz is rather cellular and easily breaks into small pieces. Mr. Ellitson showed me a number of specimens containing free gold which is of the irregular hackly type and has no trace of crystalline form. The quartz also carries some bournonite. The veins are generally narrow, ranging up to 2 inches thick. Some specimens of the dyke were chosen for assay, representing as far as possible an average sample of the formation; the result was 2 dwt. 6 gr. of gold per ton. The concentrates from three dishes of dyke material, consisting mostly of pyrites, gave 5 oz. 5 dwt. 7 gr. of gold per ton; something over 3 dwt.

of this appears to have been free gold but the rest was in the sulphides. The amount assayed was too small for this result to be taken as anything more than an indication that some of the sulphides are auriferous: it by no means proves that the concentrates as a whole contain 5 oz. of gold per ton.

[*22.7.09.*]

WOLFRAM DEPOSITS NEAR MARYSVILLE.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

About 5 miles in a direction E. 20° S. from Marysville is Mr. Ryall's camp. The country rock at Marysville is Silurian slates and sandstones, but at 1½ miles east it consists of about one mile of dacite (?) (along the dray-road); then granodiorite extends over the whole area where wolfram is being worked. Mr. Ryall's workings are just below his camp on a point between the junction of a small creek running in from the east and joining Opas Creek. These creeks flow into the Yarra. The small creek has been worked for alluvial wolfram for about 4 chains above its junction with Opas Creek, and Opas Creek has been worked for alluvial wolfram for 5 chains below the junction and for 3 chains above it. In Opas Creek a width of about half-a-chain was taken along the creek course and the depth of alluvial material ranged from 3 to 6 feet. There is a considerable proportion of quartz in the wash-dirt, and still more abundant is a breccia of quartzite and fibrous tourmaline. This breccia is said to occur as a broad belt about one mile higher up on the watershed. The wolfram is nearly all fine-grained and from the area sluiced about 1 ton of wolfram has been obtained. The bottom is decomposed granodiorite.

A chain below the hut a lode has been opened up. The strike is N. 15° W., and it is nearly vertical. It is from 3 to 6 inches thick, and consists of quartz with wolfram and iron pyrites disseminated through it, but sparsely. The lode crosses both creeks and has probably supplied much of the alluvial wolfram. The richest part opened up is where it crosses the small creek, and here a hole should be sunk upon it, for it is likely that much of the wolfram near the surface has been leached out.

Probably 30 or 40 feet would reach unaltered granodiorite, and the lode would be disclosed in its unaltered state.

Reddin's Claim.

This claim is situate about 1 mile lower down Opas Creek than Mr. Ryall's in an easterly direction, and on the east side of the creek. The rock is granodiorite in a decomposed state, seamed with quartz veins from 1 foot thick to mere threads. The strike of the principal quartz veins is W. 15° S., dip about vertical. The quartz is glassy, and particles and pieces of wolfram are disseminated sparsely through it. Iron pyrites is also present. In some of the veins brown tourmaline of fibrous character is abundant. Besides the well-defined quartz veins,

thin irregular quartz veins ramify through the granodiorite, and frequently wolfram is more abundant on these small veins than in the larger ones. In fact, this occurrence is of the character of a stockwork. Scheelite occurs with the wolfram. Mr. Reddin's workings are on a point between Opas Creek and a branch running in on the east side. About one-eighth of an acre has been washed away to a depth ranging from 3 to 10 feet. Part of this was the decomposed rock, the top portion being alluvial material. From the ground sluiced about 17 cwt. of wolfram was obtained.

If this network of wolfram-bearing veins is to be utilized it could be done only by working and crushing the material in a face. As at Mr. Ryall's, no shaft has been sunk to test the country where unaltered, and this should be done, because the surface stone may be poorer than the unaltered veins.

It is doubtful if, as the veins stand, they could be profitably worked at the average price of wolfram, but if near the topmost figures probably it could be worked profitably by crushing and concentrating. There is abundant water power for all purposes.

Between Mr. Ryall's workings and Mr. Reddin's a small patch of alluvial was worked on Opas Creek by Mr. Ryall's party. Here, as at Mr. Ryall's claim, the curious quartz and tourmaline breccia is strongly represented.

Keppel's Claim.

The hut is about half a mile W. 30° S. from Mr. Ryall's camp. S. 20° E., three-quarters of a mile from the hut, some alluvial work has been done on Quartz Creek, which runs W. 20° S. The ground worked, 4 chains in length along the creek, and for half a chain wide, has been sluiced for a yield of 6 cwt. of clean wolfram. There is no soil, but 1 ft. 6 in. of wash rests on soft bottom. The depth of wash, which was mostly quartz, was from 1 to 2 feet. In the quartz pebbles occasional bits of wolfram are found. Quartz Creek runs into Main Creek, which is further west. Main Creek has also been worked for wolfram for a length of $1\frac{1}{2}$ chains, and for a width of 50 feet, at about half a mile from the hut. The wash-dirt would average 1 ft. 6 in. thick, and there was 5 feet of soil to remove. The yield from the above claim is $4\frac{1}{2}$ cwt. of clean wolfram. The bottom is decomposed granodiorite, with flat veins of fibrous tourmaline through it. Wolfram Creek is about 200 yards east of the hut. Two paddocks have been sluiced out. The wash and soil is about 5 feet deep. It was at this site that wolfram was discovered fourteen years ago by Mr. Robinson. About eighteen months ago Messrs. Robinson, Andrews and Keppel re-started the search for wolfram and have won 22 cwt. At the head of this creek are quartz veins carrying wolfram in granodiorite country rock.

Wolfram has been found over a tract of country said to be 2 miles square. There is a wide field for further prospecting. It is by no means certain that either the best alluvial or the best lode wolfram has yet been discovered.

What has been found is scarcely profitable to work at present rates, but if very high prices prevailed it might be made profitable; the discovery of lodes rich in wolfram might occur. The discovery is interesting and may be valuable. The country, also, is worth searching for other metals.

There are traces of tin ore at Mr. Reddin's, and the remarkable quartz and tourmaline breccias are well worth careful prospecting.

[*12.2.08.*]

THE MORNING STAR MINE, ALEXANDRA.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

This mine is situate on the west side of U.T. Creek, about 1 mile west of Alexandra. A 5-head battery is being erected on the bank of the creek, and a tunnel is to be driven westerly into the hill, along the course of a diorite dyke, which cuts through the Silurian slates and sandstones. The dyke strikes W. 20° N. and dips southward at 45°. and is from 6 to 20 feet thick in different parts of its course. The walls of the dyke are most irregular; thin quartz veins carrying gold ramify through the decomposed dyke, and the whole is broken out and crushed. On the east side of the hill two shafts, 30 feet deep, have recently been sunk. On the top of the hill, which is about 150 feet high, is an old shaft, and for about 12 miles down the western slope are old workings. The deepest shaft is about 120 feet to the bottom, and the tunnel is to be driven below this so as to open up deeper ground by winzes. A quartz reef 5 inches thick, and striking S. 40° E., intersects the dyke near the deepest shaft.

The small gullies on the north and south of the dyke have been worked for alluvial gold, the former for about 7 chains in length below the reef. Both gullies run westerly into Johnson's Creek.

[*10.11.08.*]

THE ROYAL STANDARD MINE, NEAR WOOD'S POINT.

By O. A. L. Whitelaw.

The Royal Standard mine is situated 12 miles east of the township of Wood's Point, on the southern side, and near the head of Standers' Creek, an affluent of the Goulburn River.

The remarkable history of the discovery and development of this reef has probably been the subject of discussion on nearly every mining field in the world. In the early sixties, Messrs. Singleton and Stander, while searching for lost horses, discovered the outcrop of the reef, which protruded several feet above the surface of the hillside. It is said that the gold was so coarsely disseminated through the matrix of the reef that it was plainly visible from over 100 feet distant. Under great difficulties, crushing machinery was installed on Standers' Creek, 800 feet below the reef outcrop, and crushing was commenced in May, 1866.

During the first six months, 2,000 ounces in excess of half-a-ton of gold was obtained, and £44,800, equal to £28 per 1-1600 share, was disbursed in dividends. At a depth of 70 feet the gold was lost, and has not since been recovered.

In all, twenty-one adit levels have been driven towards the spur on which the reef outcropped, but two only of these have intersected the line of the lode. These, known as Nos. 13 and 14, are approximately on the same level, about 140 feet below the outcrop. No. 13 cuts the lode line in the direction of its pitch, and north of the quarry from which the rich stone was taken there is distinct evidence of faulting (probably by a cross-

course) in the adit. No. 14 intersects the lode line almost vertically under the south end of the quarry. At this point several feet of quartz was cut, and was driven on for a few feet north, and a rise put up to the quarry workings. The reef has not been driven on south.

This embraces the full amount of work done on the Royal Standard line of reef below the surface.

During the last twelve months, Messrs. Clarke and Mackey have trenched the outcrop of the reef for about 10 chains south of the quarry and opened on quartz at various points. A trial crushing from a 20-ft. shaft returned 4 dwt. of gold per ton. In addition, at about 100 feet south-east from the rich quarry, a shaft was sunk to a depth of 20 feet and then connected by shallow adit, which was driven west across the beds. This discloses an eastern dipping leg 5 feet in thickness and some smaller stone on the western leg. A trial crushing from here returned 4 dwt. per ton.

The other adits in the Royal Standard range have cut eastern side lines known as Mulholland's, the Oriental, and the Strap and Buckle. The last is next to the Royal Standard reef.

I have not at hand the records of gold yields from these reefs, but Mulholland's is said to have returned as much as 20 oz. per ton, the Oriental 2 oz. per ton, and the Strap and Buckle (from large stopes) 15 dwt. per ton.

The beds are yellow phyllitic clay-slates of Ordovician age; sandstone is represented only by a very few small bars about 1 inch in thickness. These have been subjected to great lateral pressure, which, in such homogeneous beds, has produced a high degree of cleavage; the bedding planes being represented by lines of colour, at times discernible with great difficulty. The beds have been bent into anticlines and synclines, at least four of the former occurring between Standers' Creek and the top of the range. The average strike of these folds is N. 40° W., and the general pitch about 15° N.

An exhaustive examination of the sections disclosed in the adit tunnels indicates that the auriferous reefs enumerated above are closely associated with the lines of anticlinal curvature, and I am convinced that, if the Royal Standard reef and its associated side lines, which range up to 8 feet and 10 feet in thickness, are to be again placed upon a profitable footing, it will be by applying to this field the experience gained in the development of the saddle reefs of the Bendigo gold-field.

As regards the rich reef worked in the Royal Standard quarry (which was one of the series of western legs), I am satisfied that the shoot of gold was practically exhausted in the upper workings, and that prospecting operations should be directed towards ascertaining if there is a recurrence of surface conditions in lower saddle reefs, and not, as has been the case in the past, on the assumption that the reef was dislocated, or the shoot of gold diverted.

In my opinion, there is ample justification for further developing these lines of reef. The most suitable adit for this purpose is the one lowest down the Strap and Buckle gully. This should be extended west under the Strap and Buckle reef and Royal Standard workings, and then connected with the stopes of the former by a rise in the anticline, and with the latter by a rise in the anticline to No. 14 adit level.

The distances to be driven, and heights of the rises, are indicated on the plan of my underground survey of the mines.*

* This will be issued with the Memoir on the district.

Subjoined are the details of returns of gold from the Royal Standard quarry :—

RETURN SHOWING GOLD YIELDS FROM ROYAL STANDARD MINE, WOOD'S POINT.

Year.	Date of Crushing.	Yield.	
		oz.	dwt.
1866	1st June	19	0
,, ...	16th ,, ...	1,755	10
,, ...	22nd ,, ...	1,179	0
,, ...	7th July	1,851	0
,, ...	19th ,, ...	1,231	10
,, ...	3rd Aug.	1,360	10
,, ...	17th ,, ...	1,363	10
,, ...	31st ,, ...	1,151	0
,, ...	14th Sept.	706	10
,, ...	28th ,, ...	726	10
,, ...	12th Oct.	727	10
,, ...	26th ,, ...	681	0
,, ...	9th Nov.	873	0
,, ...	23rd ,, ...	535	0
,, ...	8th Dec.	606	0
,, ...	22nd ,, ...	411	0
1867	8th Jan.	197	0
Total ...	... ...	15,374	10

[13.12.09.]

THE TOOMBON MINE, WALHALLA DISTRICT, GIPPSLAND.

By W. Baragwanath.

The Toombon mine is situated on a small creek of the same name about half-a-mile east of the Aberfeldy River, of which the Toombon Creek is a tributary. Work at the mine was commenced early in the seventies, and was continued, with but short interruptions, until the end of 1897.

The chief interest attached to the mine lies in the fact that it is situated midway between the well-known gold-fields of Walhalla and Wood's Point, and that, with the exception of the Walhalla mines, profitable workings were carried out to a greater depth than on any other reef in Gippsland.

The shaft—the sill of which is 1,950 feet above sea level—is situated on the western edge of the Walhalla-Wood's Point geo-synclinal fold in strata consisting of alternate thin beds of slate and sandstone* with occasional larger sandstone bars. About 10 chains east of the shaft runs a belt of fossiliferous grit which is traceable for several miles northerly and southerly, and which forms the eastern limit of the proved auriferous

* Locally called elvan.

belt of country stretching from south of Walhalla past Toombon, Aberfeldy, Matlock, and through Wood's Point northerly. Numerous dykes intersect the strata in the vicinity of Toombon. These are well shown in the various road-cuttings. The dykes vary from a few inches to upwards of a chain in width, and are for the greater part much decomposed. An exposure of undecomposed dyke over 100 feet wide occurs about three-quarters of a mile east of the mine.

A road, which is, on the whole, fairly well-graded, passes within a stone's throw of the shaft. This road, which is suitable for vehicular traffic, starts from Heyfield, on the Bairnsdale railway line, and terminates at Aberfeldy. A pack-horse track connects with Walhalla, distant 25 miles.

As no work has been carried on at the mine since 1897, it was impossible during my stay in the locality in 1903 to inspect the workings, which were at that time full of water to the adit level. The following history and account of the reef and mine-workings has therefore been compiled from the most reliable sources as detailed in the Bibliography.*

The reef was first prospected early in the seventies by Messrs. Fleming, Pettit, and others, who proved the reef to be "from 3 feet to 6 feet wide, of good appearance, and full of pyrites." No records of this party's yields could be obtained.

In 1871 the Aberfeldy Company was formed, and by the end of 1872 a battery of ten heads was erected. A trial crushing does not appear to have been satisfactory, and work ceased till 1875, when twenty men were employed. In 1876 the company stopped work, although at that time "the mine was looking well, and great results were expected."

In the beginning of 1877 James Rice bought the mine and worked it with considerable profit until June, 1881, when it became the property of the Toombon Company.

The Toombon Company at the end of 1881 started a new main shaft and erected pumping and winding machinery at the present site. At 96 feet a cross-cut intersected the reef, which was 4 feet wide, carrying fair gold. At 180 feet below surface the shaft passed through the reef, and a drive was put in north and south along its course. By the end of 1884 the mine had paid off all its liabilities and commenced to pay dividends. In 1886 more powerful machinery was erected, and the company still maintained its payment of dividends. At the end of 1887 the reef had been proved in winzes below the 280-ft. level to be over 4 feet wide and of good quality. The main shaft was sunk to a depth of 605 feet by June, 1889, at which time the reef in the level above was proved to be from 2 to 8 feet wide, with a length of shoot of 370 feet, and a pitch southerly at an angle of 32° 20′. In December, 1889, the company ceased operations, and the mine remained idle until reconstructed in 1892, when the new company started work at the No. 6 level and found payable stone in several places. A winze on the underlie of the reef was started from the intersection of the cross-cut. This winze, which eventually was carried down to a depth of 400 feet, was worked by a "tail rope" fixed below the cage in the main shaft, and carried along the cross-cut on rollers. At the No. 7 level, 100 feet deep

* A Contribution to the Bibliography of the Economic Geology of Victoria. Prof. J. W. Gregory, D.Sc, F.R.S. Rec. Geol. Surv., Vict., Vol. II, Pt. 3. 1907.

in the skip-shaft, the lode was driven on north and south, and prospecting operations were also carried out in the upper levels, where, at No. 5 level, the south drive was extended to 645 feet south. The No. 7 level carried a lode 2 feet thick, with good gold; south for 31 feet the lode was small.

At the 760-ft. level the drive north for 20 feet carried a formation 3 feet thick, with but little quartz. From 20 feet to 80 feet the lode averaged 2 feet thick and showed a little gold. South at this level the reef was small, and appeared to make better underfoot for 60 feet. At 87 feet a shoot of stone 18 inches thick, of payable quality, was met with and driven on to 220 feet. A winze was put down on this shoot of stone at 90 feet south of the skip-shaft. In the winze the lode opened out to 3 feet thick at 20 feet and improved in quality, and at 48 feet the lode averaged 4 feet and was highly payable. Stoping above the 760-ft. level was carried out on this make of stone.

At 820 feet below the surface another drive was put in from the skip-shaft. For 76 feet north the reef averaged 2 feet in width and carried a little gold. South of the skip-shaft the reef averaged 1 foot in width, with good gold, for 30 feet; then the lode became broken by the influence of a large slide which cut off the lode in the skip (or underlay) shaft at 10 feet below this level. Below this point the skip-shaft was carried for about 30 feet in the slide and thence in country rock.

At 920 feet below the surface a plat was cut, and a cross-cut put out west cut the lode at 55 feet from the shaft, showing that the slide had thrown the reef 60 feet westerly. The reef where intersected was from 3 feet to 3 ft. 6 in. in width, and was driven on north for 70 feet. South of the skip-shaft, at 48 feet from the cross-cut, the shoot came in 4 feet in thickness. At 65 feet the lode split; the western vein was followed for 30 feet, 20 feet of which was from 6 inches to 2 feet in width and highly payable. This drive was put in to 82 feet and the reef stoped up to the slide. The main level was continued to 162 feet on the eastern vein. To 106 feet the reef averaged 2 feet, carrying fair gold.

At 1,020 feet in the skip-shaft the cross-cut cut the lode 54 feet west of the shaft. The reef averaged 18 inches in width and carried gold for 70 feet north. South of the cross-cut at 20 feet the lode split, and the south-western vein was followed. At 90 feet from the cross-cut a cross-cut was put in easterly and the eastern vein cut at 29 feet from western vein and a drive put in south. At 150 feet south of the main cross-cut a winze was sunk to a depth of 90 feet. At 50 feet in this winze a level was put in north 55 feet; the first 10 feet carried a reef of good quality from 6 inches to 2 feet wide. At 20 feet the drive was turned west to strike the rich shoot worked in the level above, and at 52 feet this run of gold was found, from 6 inches to 1 foot wide, and of good quality. The drive south from this intermediate level was put in 42 feet on a lode which opened out to 4 feet wide and showed good gold. Work at the mine ceased soon after this work was carried out. The last report of the mine manager states, under date of July, 1897, "There is a large quantity of stone available for stoping, and some of the veins are particularly rich. A decided improvement has been made by adopting the principle of driving cross-cuts and two other lodes have been discovered, both showing good gold." Shortly afterwards the mine shut down. The last yield from the lower levels (July, 1897) was 324 oz. 10 dwt. from 200 tons; but with the expensive method adopted for working, this left no profits for the shareholders.

The following extract from a report* on the mine by Mr. R. A. F. Murray, formerly Government Geologist, may be added:—"The Toombon mine is one of the oldest mines in the district, and yielded well many years ago. The last company received many thousands of pounds in dividends, but left off work on finding poor stone at one of the levels. The present company got a continuation of good stone at a deep level, and are now working profitably, though under difficult circumstances as regards mining. The main shaft is 600 feet deep, perpendicular, and from a cross-cut thence the lode has been followed down a further distance of 400 feet on its north-eastern underlie by means of an underlie shaft. At about 800 feet a slide throws the lode back south-west, so that from the No. 9 and No. 10 levels cross-cuts have been made back from the underlie shaft. The shoot of payable stone is about 300 feet in length, and had a southerly pitch down to about 700 feet. Thence, as described by the manager, Mr. Gilbert, it goes down straight, then pitches northerly to No. 9 level, and now at No. 10 level, 1,000 feet from surface, resumes its southerly pitch."

"At No. 10 level the lode looks very well, being up to 4 feet thick, well-defined, and going down strongly underfoot. . . . . This mine appears likely to continue remunerative to great depths, and the grand desideratum is a good main shaft, so as to command the lode at a depth on its pitch and underlay."

The following table gives a list of yields so far as I have been able to compile them from official and mine records, which, although not complete, are the most reliable available.

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* Report on Recent Gold Mining Developments between Wood's Point and Walhalla. Spec. Rept. Department Mines, 1896, p. 3.

LIST OF YIELDS FROM THE TOOMBON MINE.

Company.	Year.	Quarter Ending— March. Tons.	Oz. dwt. gr.	June. Tons.	Oz. dwt. gr.	September. Tons.	Oz. dwt. gr.	December. Tons.	Oz. dwt. gr.	Total. Tons.	Oz. dwt. gr.
Aberfeldy Company ..	1872	..	..	..	..	..	..	450	93 15 0	450	93 15 0
	1873	337	81 0 0	470	146 2 0	..	..	..	..	807	227 2 0
	1875	..	..	..	..	90	203 0 0	..	..	90	203 0 0
James Rice & Co. ..	1877	..	..	425	268 11 0	..	..	435	278 11 0	860	547 2 0
	1878	350	107 19 0	..	..	430	245 14 0	1,300	858 5 0	2,080	1,211 18 0
	1879	350	312 10 0	300	158 12 0	650	196 19 0	1,365½	1,100 17 0	2,665½	1,768 18 0
Toombon Company ..	1884	403	203 10 0	903	1,199 0 0	867	781 5 6	1,295	1,165 12 0	3,468	3,349 7 6
	1885	550	598 17 0	1,060	1,125 3 3	1,350	2,032 9 0	1,310	2,227 12 0	4,270	5,984 1 3
	1886	1,000	706 5 0	1,010	790 6 0	1,340	1,152 16 0	2,200	1,858 5 0	5,550	4,507 12 0
	1887	2,133	1,157 7 0	2,164	1,062 14 0	2,378	2,004 0 0	4,595	3,682 2 0	11,270	7,906 3 0
	1888	2,126	1,308 4 0	1,465	841 16 0	1,305	1,297 5 0	1,649	1,089 3 0	6,545	4,536 8 0
	1889	1,912	981 17 0	1,375	895 10 0	1,817	1,128 12 0	1,698	896 3 0	6,802	3,902 2 0
	1890	369	255 4 0	542	173 7 0	1,512	461 17 0	..	..	2,423	890 8 0

List of Yields from the Toombon Mine—*continued.*

Half-yearly Returns.

Company.	Year.	Half-year ending— January. Tons.	Oz. dwt. gr.	July. Tons.	Oz. dwt. gr.	—— Tons.	Oz. dwt. gr.	Total. Tons.	Oz. dwt. gr.
New Toombon Co.	1893	339	733 0 0	673	454 10 0	..	..	1,012	1,187 10 0
	1894	535	185 2 0	645	668 0 0	..	..	1,180	853 2 0
	1895	2,045	1,602 0 0	2,120	1,252 0 0	..	..	4,165	2,854 0 0
	1896	1,490	971 0 0	770	947 8 0	..	..	2,260	1,918 8 0
	1897	1,655	1,100 0 0	1,695	1,305 0 0	2,641	2,173 0 0	5,991	4,578 0 0

Return from Pyrites.

Year.	Quarter ending— March. Oz. dwt. gr.	June. Oz. dwt. gr.	September. Oz. dwt. gr.	December. Oz. dwt. gr.	Total. Oz. dwt. gr.
1887	..	73 18 9	52 18 0	..	126 16 9
1888	64 12 0	142 0 20	31 4 12	85 12 0	323 9 8
1889	44 11 6	48 14 10	62 14 9	42 19 18	198 19 19
1890	53 2 4	10 14 16	11 16 4	..	75 13 0
1894	22 3 0	..	10 3 0	..	32 6 0
1897	..	..	184 0 0	..	184 0 0

Yield from Pyrites, 1894–1897, included in yields above.

THE CORONATION GOLD MINING COMPANY (LATE TUBAL CAIN), WALHALLA.

By W. Baragwanath.

The workings of the Coronation Gold Mining Company, Walhalla, are situated in a large mass of igneous rock known as the Tubal Cain dyke, and located on the eastern side of the eastern branch of Stringer's Creek, about 2 miles slightly to the east of north from the junction at Walhalla.* The chief feature of the Coronation mine workings is the occurrence of rich auriferous reefs associated with the so-called "dyke" outcrop. This "dyke" outcrop is all the more interesting on account of its almost circular shape and comparatively large extent, having a maximum length of 850 feet by an extreme width of 700 feet, and being but slightly indented at one extremity. The shape suggests a neck or plug rather than a "bulge" or sudden expansion of a continuous line of dyke, as in the Wood's Point district;† no evidence of any such continuous dyke could be found.

In texture the dyke varies considerably, probably through the differentiation of the magma during consolidation; portion of the dyke consists of coarsely crystalline rock of granitic appearance, while other portions are fine grained, dense, and apparently non-crystalline. The dyke decomposes irregularly; in places in the upper or shallow-level workings it has decomposed till it is little more than a stiff clay with occasional nodules of undecomposed rock, while at other places hard rock shows over several feet on the surface. An examination of samples from the "dyke" is quoted in the above-mentioned report on Walhalla, page 57, from which it appears that the "dyke" may be classed as an augite-diorite. No evidence as to the geological age of the dyke is obtainable, except that it is undoubtedly post-Silurian, the surrounding strata through which it has broken being of Silurian age. For a distance of 20 to 30 feet from the edge of the "dyke," the strata have been indurated.

A number of roughly parallel fissures, all having a westerly dip, occur within the "dyke." These fissures have a general strike of about N. 45° W., and a dip of 30 feet horizontal in 100 feet vertical. Faulting appears to have taken place along these fissures, the texture of the dyke on opposite sides often differing. Along these fissures the quartz reefs which have been worked occur. In the decomposed portions of the dyke the reefs are often irregular and spurry but have proved to be very rich in places, while in the less decomposed dyke the nature of the reefs is more apparent.

The character of the quartz is somewhat peculiar. In the decomposed dyke, the quartz varies but slightly in appearance, being commonly opaque and white, or iron-stained. In the harder portions of the dyke, however, the quartz is more vitreous, and ranges in colour from white to black; portions of the reef are made up of a semi-opaline mass; other portions are more or less ordinary quartz with included fragments of dyke, the edges of which often show a gradual transition into quartz, indicative of a metasomatic replacement. Much calcite, derived probably from the decomposition of the dyke constituents, occurs in the main reef channels or along

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* For a locality plan see Report on the Walhalla Gold-field, by H. Herman, Spec. Rept., Dept. Mines, Vict., 1901.

† See The Wood's Point Gold-field, by O. A. L. Whitelaw, Memoirs Geol. Surv. Vict., No. 3, 1905.

small fissures parallel to the main lines of reef. Iron pyrites is plentiful throughout the reefs, and may also be seen in the dyke itself below water-level. It commonly occurs in very small crystals, either cubical or elongated prisms (needle pyrites).

The fissuring of the dyke appears to have been due to movements within the dyke caused by shrinkage, as no evidence of their existence in the adjacent strata was obtained, and the reefs appear to become very broken towards the edges of the dyke. Near the circumference of the dyke, concentric breaks are noticeable.

The first work done on these fissure reefs was in 1865, when the Girl's Reef was found "cropping out on the surface about 2 feet in thickness, containing very good gold. On either side of the prospecting claim are leases—Tubal Cain, Vulcan, and others. Some very rich leaders have been found by trenching (in the Tubal Cain claim)."* During 1866, the Girl's Reef Company and Tubal Cain Company were formed, the deepest workings at that time being shafts of 60 feet in depth. Long adits were driven, and very rich blocks of stone proved and worked. The Tubal Cain Company erected a battery in 1866.

Very little information concerning these old workings is now obtainable; and, as they were at the time of the survey mostly closed, their nature and extent could not be fully ascertained. The record of some yields is attached (Appendix A).

The Tubal Cain engine-shaft was sunk near the northern edge of the dyke to a depth of 310 feet. A level was opened out at 300 feet, and in the east cross-cut at 50 feet from the shaft a reef 4 feet wide was cut, and drives north 50 feet, and south 100 feet, put in along it. A winze, sunk to a depth of 8 feet, at 20 feet north of the cross-cut on this reef, yielded 1 ton of stone, which gave 8 oz. of gold. Work in the winze was suspended on account of the water proving too heavy, and the mine, which had during the previous six months paid £1,200 in dividends, closed down. To a depth of 300 feet, over 30,000 oz. of gold is reported to have been obtained from this dyke.

The following information about the accessible workings was obtained. The old Tubal Cain adit was driven in an easterly direction, the entrance being in Silurian strata. Sixty feet from the entrance the western edge of the dyke, here decomposed, was struck. At 200 feet in, a break, concentric with the north-western edge of dyke, was met, and a drive was put in south-westerly along this for a distance of 100 feet, where the Girl's Reef was struck. Much slipping and faulting movement is indicated by the striated and slickensided surfaces in this drive. The drive was turned south-easterly along the Girl's line of reef. When cut, the reef was small and dipped west at 70°. One hundred feet along the drive a new make of stone comes in on the eastern side; this was followed for over 100 feet, and averaged 2 ft. 6 in. in width, with a dip of 56° west. The drive was put in on the hanging wall, leaving the reef standing the greater part of its length. The face of the drive is 350 feet from the cross-cut. Thirty feet from the face the drive was turned westerly away from the line of reef. No stoping was done on this level, nor was any connexion made with the surface workings.

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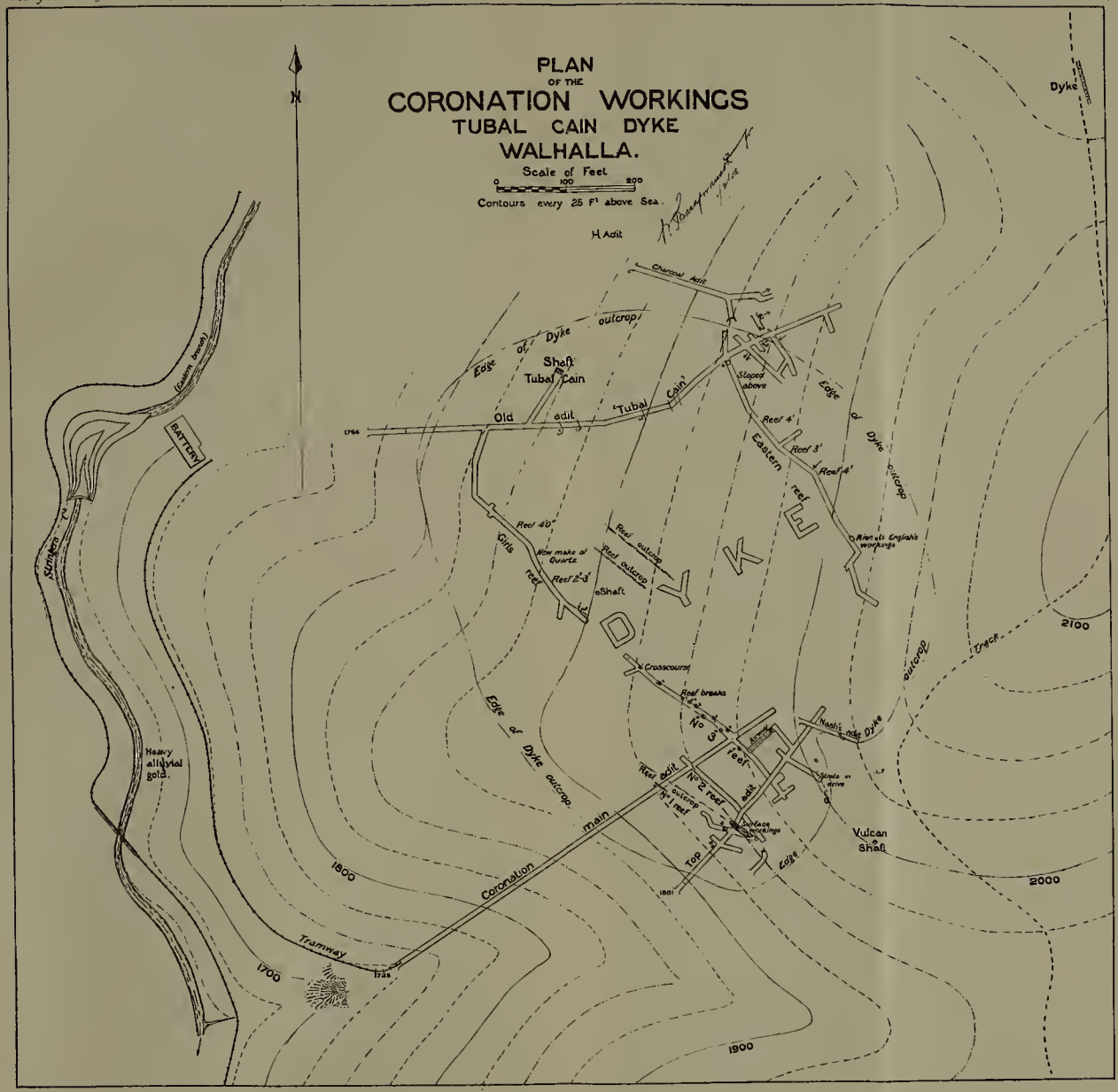
* Dicker's Mining Record, Nov. 7, 1865.


PLAN
OF THE
CORONATION WORKINGS
TUBAL CAIN DYKE
WALHALLA.
Scale of Feet
0 100 200
Contours every 25 Ft above Sea.
N
H Adit
Charcoal Adit
Edge of Dyke outcrop
Shaft Tubal Cain
Old adit
Tubal Cain
Sloped above
Edge of Dyke outcrop
Reef 4'
Reef 3'
Reef 4'
Eastern reef
Reef 40'
Girls reef
Reef outcrop
Reef outcrop
Reef 2'-3'
Shaft
DYKE
Crosscourse
Reef breaks
No 3 reef
Adit
Nash's reef
Dyke
Reef adit
No 2 reef
Adit
Reef outcrop
No 1 reef
Surface workings
Main
Top
Edge
Vulcan Shaft
Coronation
Tramway
Track
outcrop
Dyke
Slopers
(Eastern boundary)
BATTERY
Heavy alluvial gold.
1744
1800
1700
1725
1801
1900
2000
2100

BRITISH MUSEUM
NATURAL HISTORY

The main adit level was connected with the Tubal Cain shaft, and was used for trucking material to the battery, and also for saving the pumping of water to the surface.

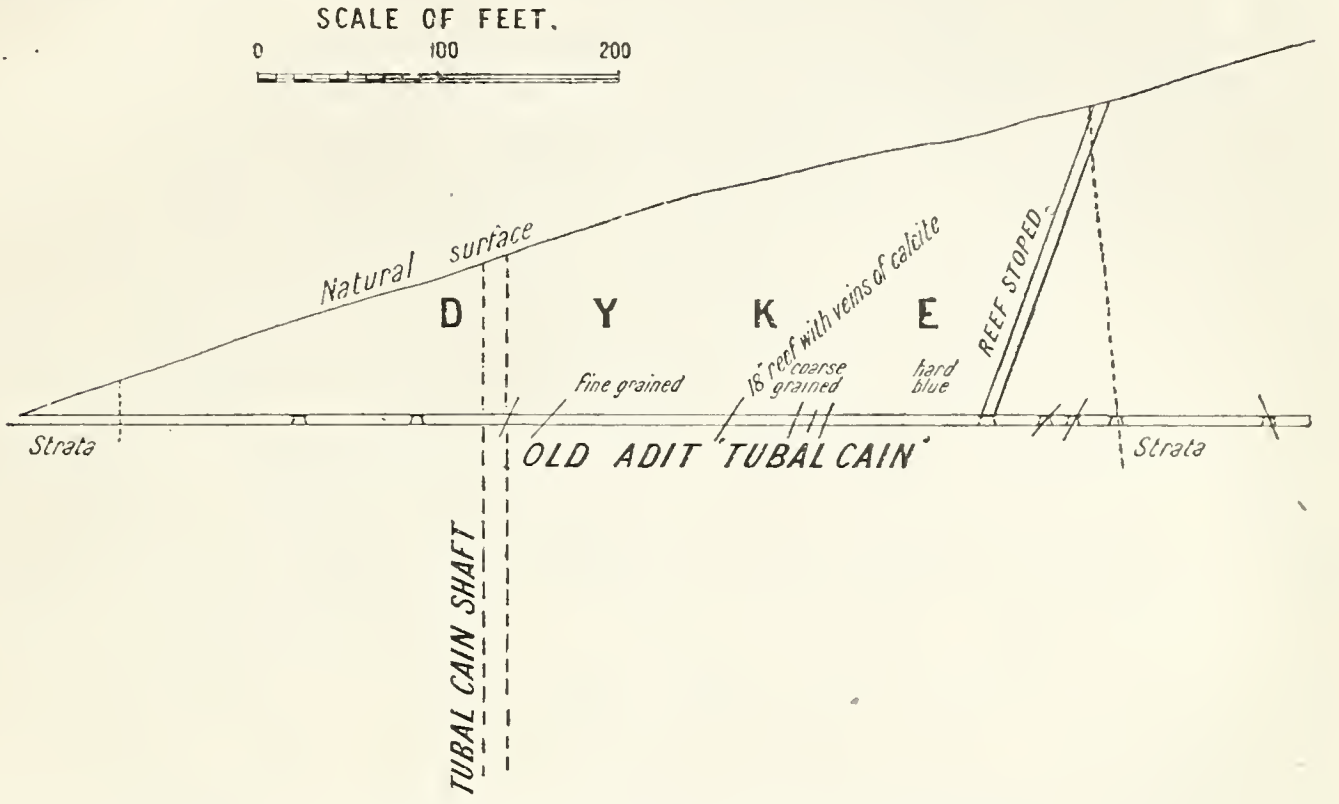


FIG. 33.—Section along the Old Tubal Cain Adit.

In the main adit cross-cut a number of small quartz reefs, as shewn on the accompanying section, were passed through, the largest of these being 18 inches wide where intersected at 400 feet from the entrance. Much calcite occurs in this portion of the dyke. No driving was carried out on any of these veins, which may have auriferous shoots, nor on the larger bodies of stone which are seen to occupy fissures similar to those along which the various reefs have been worked.

At 540 feet from the entrance, drives were put in north and south on a formation dipping west. Stoping was carried out above this level to the surface, and a winze sunk underfoot. The main south drive shews stopes over 80 feet in length, while a reef from 3 to 4 feet wide was driven on further south for over 200 feet. About 300 feet from the cross-cut a rise was put through to English's workings in the adit above, but no stoping was carried on from the rise. The south face of the drive at 433 feet from the cross-cut shews numerous leaders in soft dyke, but the reef and its wall appear to have broken up.

In the main cross-cut the eastern side of the dyke was cut at 630 feet from the entrance, and a drive put in along the contact with the strata for about 70 feet.

Between the main south drive and the edge of the dyke two drives were put in southerly along small makes of stone in soft dyke. At this level the dyke has decomposed for a width of about 60 feet from the edge, the central portion being of a hard blue colour with a granitic texture at 450 feet from the entrance of the adit.

No record of the extent of English's workings was procurable.

The Charcoal adit is reputed to be between 700 and 800 feet in length, but was inaccessible at time of my survey. A connexion was made to this from the old Tubal Cain adit.

Chalwell's adit, driven from a point about 750 feet south-east of the entrance to the Tubal Cain adit, consists of a cross-cut over 300 feet in length, running in a north-easterly direction. The full length of this

cross-cut is in decomposed dyke, which forms the southern portion of the outcrop. At 100 feet from the entrance a drive was put in north and south along a spurry formation, and a winze sunk below the level to a depth of 60 feet. A rise from this point connects with surface workings, which appear to be about 60 feet in length. About 25 feet east of these reef workings another drive is put in north and south on a wall with a westerly dip. A small amount of underhand stoping, as well as rising, has been carried on from this drive, but the formation is small. At 150 feet from the entrance a small reef 8 inches thick with a westerly dip of 45° was passed through. At 200 feet from the entrance a drive was put in on a formation which has been stoped to the surface. Fifty feet south of the cross-cut, Silurian strata were met with on the footwall of the reef, and a fair body of crushing material (spurry formation carrying a little gold) proved. The extent of this make could be tested only by driving, but it is probable that it will form only as a contact make and die out as the southern edge of the dyke is reached. A winze was sunk to a depth of 36 feet from a point 30 feet south of the cross-cut. The dip of this winze would, if continued, connect with the No. 2 reef in the Coronation adit. Fifteen feet east of the reef workings a connexion was made, by a winze from a short north drive, to the stopes from the Coronation adit. By this an airway was formed which ventilates the main workings of the Coronation company. In the decomposed portion of the dyke at this level veins of impure manganese ore (wad) are noticeable.

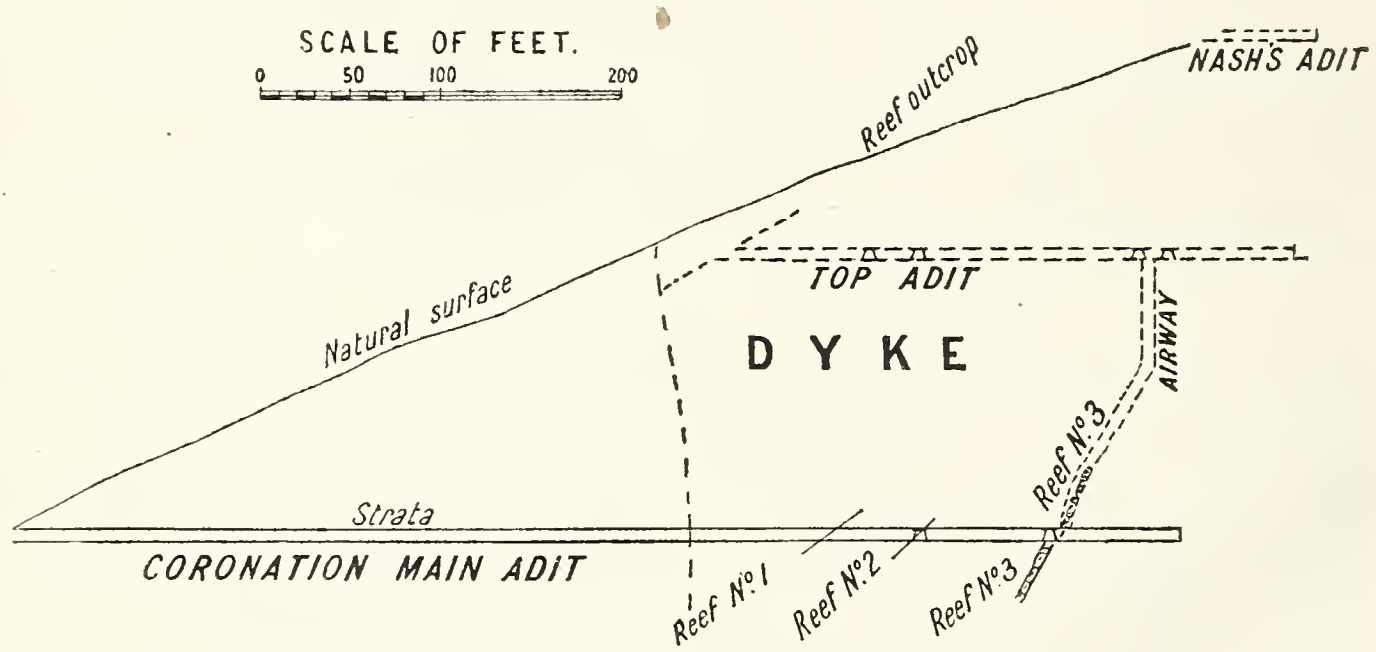


FIG. 34.—Section along the Coronation Adit.

The Coronation main adit, to which operations have for the past five years been confined, was started from a point 750 feet south of the old Tubal Cain adit and 420 feet west of the mouth of Chalwell's adit. The cross-cut has a bearing of N. 56° 46′ E., and intersects the dyke near its southern edge at 370 feet from the entrance. The strata passed through have a general easterly dip of from 70° to 80° for 280 feet, where a sharp roll with a southerly pitch of 10° is met with. The remaining strata till the dyke is reached dip easterly at an angle of about 50°. Cleavage is vertical. At 450 feet from the entrance the first formation, No. 1 reef, was passed through; this consisted of from 6 to 12 inches of quartz with two good walls and a westerly dip of 45°. Fifty feet further east another make, No. 2 reef, carrying up to 18 inches of quartz was intersected. A drive was put in south-east on this for 150 feet. About 80 feet south of the cross-cut soft

dyke was met with, and the reef became more broken. Seventy feet north-east of No. 2 reef, or 570 feet from the entrance, No. 3 reef was met with. This reef was about 12 inches wide with a westerly dip of 45° where cut and carried payable stone. The main operations of the company were then confined to driving north-west and south-east along this No. 3 reef and stoping above and below the adit level. The main drive southerly carried good stone for 40 feet from the cross-cut. The dyke on the footwall was of a red colour, probably due to decomposition of iron pyrites. A series of very rich veins was found coming into the reef channel from the east. Sixty-five feet south of the cross-cut a small break or vugh occurred in the lode-channel; 80 feet south of the cross-cut a vein dipped towards the main reef at an angle of 30°, and was worked for about 15 feet, when it became thin. At 110 feet the reef appears to end or to be cut off by concentric breaks near the edge of the dyke. Short cross-cuts south of this point failed to prove the continuance of the formation. Judging by the surface outcrop the southern edge of the dyke will be about 60 feet ahead of this face. Northwards along the reef the drive was put in a distance of 200 feet. At 162 feet from the cross-cut a crosscourse was met with; this displaced the reef about 2 feet to the east going north.

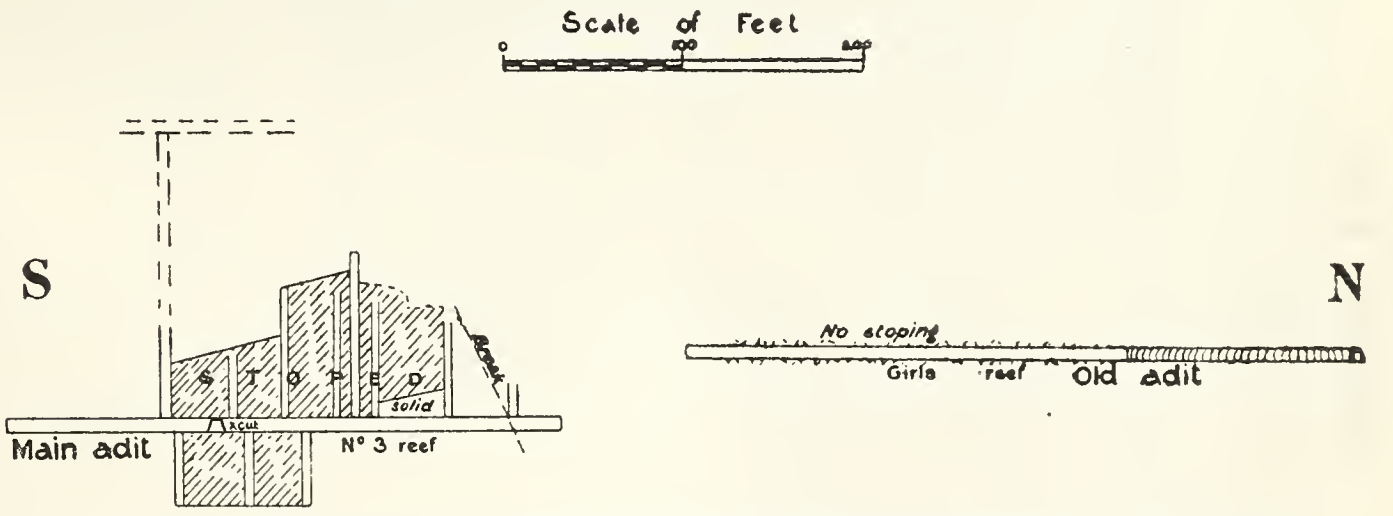


FIG. 35.—Section showing the extent of stoping on No. 3 reef, Coronation Adit, and the drive along the Girl's reef from the Tubal Cain Adit.

The stopes over the level were upwards of 200 feet in length, and at a height of 60 feet above the level the decomposed dyke was met with. Very rich gold was obtained near the junction of the decomposed and undecomposed dyke. In the undecomposed dyke a large body of quartz, highly mineralized but of low gold value, was met north of the main rise; the reef in the stopes had a westerly dip of 71°. At 80 feet above the level a rich leader was worked on the western side of the main reef. The reef in the stopes varied greatly, at times white, again it would be semi-opaline, or again black, the gold not appearing to favour any particular class of stone, but being distributed throughout.

Details of these workings are supplied in Appendix B attached.

APPENDIX A.

The following yields are taken from the Reports of the Mining Surveyors and Registrar:—

1868	...	703 tons yielded 214 oz. 11 dwt.	--	100 feet deep.
1869	...	48 tons yielded 11 oz. 9 dwt.		

APPENDIX B.

The following data of yields, &c., have been supplied by S. F. Drakeford, Esq., Legal Manager of the Coronation Gold Mining Company:—

CORONATION SYNDICATE G. M. Co., WALHALLA.

Quarter Ending.	Tons Crushed	Gold Yield.	Gold Average per ton.	Value.	Calls Made.	Dividends.	Where Crushings obtained and Record of Quarters' Work.
		oz. dwt. gr.	oz. dwt. gr.	£ s. d.	£ s. d.	£ s. d.	
December, '03	18	34 0 5	1 17 18	124 9 10	60 0 0	..	Stone from where No. 3 reef was cut in cross-cut and about 30 feet of north drive. Crushed at Long Tunnel Battery.
March, '04 ..	..	..	..	..	180 0 0	..	South level on No. 2 reef driven 130 feet; a little gold all the way, but not payable; battery being put in order.
June, '04 ..	99	56 1 12	0 11 8	204 4 0	240 0 0	..	Level driven south on No. 3 reef 30 feet from cross-cut. Stone crushed taken from south drive and from stopes 50 feet long.
September, '04	194	84 14 12	0 8 18	304 6 1	..	..	Stone crushed from stopes 30 feet high by 50 feet long; 139 tons for 39 oz. 2 dwt. 3 gr.; from winzes, 55 tons for 45 oz. 12 dwt. 9 gr.
December, '04	227	261 8 8	1 3 0	984 16 8	..	239 8 0	Stone crushed taken from winzes, drives, and stopes on No. 3 reef; winzes connected and north drive extended to 50 feet north from north winze. Stoping in progress in both north and south winzes. A rich shoot of stone worth 30 oz. to ton in north stopes. The rich shoot is short; country very hard.
March, '05 ..	250 Plates	298 15 9 4 4 17	1 3 22	1,130 10 9	..	239 8 0	Stone crushed came from below main level No. 3 reef; now about stoped out to level. When completed, north end will be about 80 feet from cross-cut. Reef averages 20 in., extremely hard. Water in winzes heavy.
June, '05 ..	404	306 9 15	0 15 4	1,144 11 5	..	239 8 0	Stone crushed obtained above level north of cross cut. A slide came in face of north drive at 94 feet from cross-cut, cut the reef off, but it made again. At 99 feet, gold showing freely; after that it commenced to get poorer; at 105 feet north drive, in a blank. A lot of prospecting done in old upper workings and some fair sized bodies of low grade stone placed.

September, '05	453	356	9	15	0	15	17	1,305	18	4	..	359 2 0	All stone crushed from stopes above level on No. 3 reef. Stopes now 86 feet in length by 56 feet in height. North level 145 feet. Reef looks promising but poor; very good gold in top stope. Everything going strong. North, south, and top stope not so good. South level in 114 feet, end blank; cross-cuts put in east and west. West cross-cut picked up reef going away very flat, west small but good quality, driven in 17 feet, dipped underfoot. Another cross-cut going in east on rich leaders, and a rise in level started is on a fair body, fair quality stone. Top tunnel in to 347 feet, passed through some gold-bearing leaders, probably indicates we are now approaching same lode channel as worked below.
December, '05	727	1,279	9	18	1	15	5	4,710	11	7	..	1,556 2 0	North level to 176 feet; slide cut off reef; reef was found to the east going with the slide, was followed west for 15 feet. There is quartz and a little gold and water in and through west cross-cut. Slide did not affect quality of stone close to slide, but reef got poorer further north. All stone crushed from north stopes; quality uniformly good, with occasional rich patches.
March, '06 ..	680	380	5	4	0	11	4	1,412	10	3	..	359 2 0	All stone crushed taken from stopes above No. 3 level; length of stopes 203 feet; slide has affected quality of stone. North level in to 219 feet, country hard, reef about 18 inches poor. Main cross-cut in to 723 feet, passed through two or three soft formations carrying a little gold; last one at 715 feet 3 feet wide; little gold.
June, '06 ..	595	183	5	8	0	6	4	662	11	0	..	478 16 0	North level in 239 feet; reef poor, now stopped. Stone crushed of a poor quality; gold seems to have given out at about 115 feet above level. Started new battery, now rising to surface above intermediate level. Baled out bottom workings; stone too hard to pay under present conditions. South winze 72 feet, and cross-cutted 10 feet and cut reef 2 ft. 6 in. wide, showing fair gold. Flooded out; now prospecting above No. 3.
Totals ..	3,647	3,245	4	3	..			£11,984	9	11	£480 0 0	£3,471 6 0	

Obtained 33 oz. 12 dwt. from skimming and plates after Quarter closed.

[*11.8.08*]

THE TAMLEUGH QUARTZ-REEF AND THE BASALT AREA, NEAR EUROA.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

At about 10 miles north of Euroa in allotment 37A, section 34, parish of Tamleugh, this quartz reef has been opened up. The country rock consists of Silurian sandstones and slates of grey colour. The workings comprise a shaft sunk to a depth of 60 feet some years ago, and (50 feet further north) an opening about 20 feet long, 15 feet wide, and 35 feet deep that contracts in depth. It is in this opening that work is being done. The strike of the beds is W. 5° S.; dip 75° N. The irregular quartz vein that carries a little gold strikes W. 12° N., and dips 66° S., or across the bedding. The thick sandstone bed on the south side of this small quartz vein is crossed by spurs of quartz in which a little gold is reported to occur. At 20 feet from the surface a cross-cut has been driven south for about 70 feet, and two or three small spurs, reported to have carried a little gold, were cut. In the samples of quartz shown me there was a little gold of excellent quality, but there does not appear to be much gold present. From all the work done at this site it appears that only a few ounces were obtained. Judging from the specimens shown the gold is of high quality, and it is reported to have sold for £4 3s. per ounce.

In the present workings the best plan would be to sink another 10 feet and drive east and west along the small vein of quartz that is said to give the best results. This occurrence is interesting, and resembles gold occurrences near Kilmore.

The low ridges of Silurian country are said to extend from this spot for 5 miles in a westerly direction, for 15 miles northerly, and 6 miles in an easterly direction. Gold in small quantities has been found at other points over this area, and the country offers some encouragement to prospectors as it is easily prospected. So far as the Tamleugh workings are concerned, unless a little further work showed much improvement, it is not worth spending much money upon.

About 9 miles southwards from Euroa there is an area of basalt and scoria cones overlying the surrounding granitic rocks, and marking the site of volcanic activity in Tertiary times. The largest cone is known as the Blackfellow's Head, and there are six or seven smaller cones within an area of 3 or 4 square miles. The largest development is at the old Pre-Emptive Right. Some of the cones are very diminutive, and the volcanic material from them covers only a few acres of surface. There is a considerable variety of rocks ranging from very dense to highly vesicular basalts, and tuffs also occur. The most northern portion of this volcanic area is within 3 miles of Euroa. This region appears to have been on the fringe of the extensive area of volcanic action, separated from the hundreds of square miles of basalt of Tertiary age in the Western District.

[*10.7.09.*]

THE GOLDEN BAR AND GOLDEN BAR EXTENDED MINES. CHILTERN.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The Golden Bar Mine, Chiltern.

The No. 3 level in this mine is 420 feet below the surface. From the shaft there is a western cross-cut 120 feet long to the reef, and a level runs north along the course of the reef for 290 feet from the cross-cut. At this point a fault intersects the reef; the strike of the fault is N. 25° W., and dip 80° W. The fault cuts the reef off and throws it 40 feet to the northward. The fault was followed northward for 70 feet, and at this point the reef is 10 feet to the east of the fault. The mixed quartz and slate is 4 feet thick. In the western portion of the reef, which is 1 foot thick, gold shows in the quartz. From this level to the surface this reef is intact.

No. 5 level is 620 feet from the surface. A reef is cut in the bottom of the shaft a few feet below the level. This reef is about 1 ft. 6 in. thick, and gold shows in the quartz; the manager considers this stone to contain about 18 dwt. of gold per ton. The strike of the reef is N. 25° W., and the dip is 75° W. The level is driven on the reef 60 feet to the north and 60 feet to the south. From the shaft a cross-cut is driven west for 70 feet to the No. 1 reef, which here is 1 foot thick; strike of reef N. 20° W., dip 80° E. This reef appears to conform to the beds of the country rock. A rise has been put up 20 feet above the level ready for stoping. A level is run south along the reef for 65 feet, and north 55 feet. The total length of the western cross-cut from the shaft is 160 feet.

The reef has been cut again where the fault displaced it, and the mine generally has a favorable aspect.

The Golden Bar Extended Mine.

This mine adjoins the Golden Bar mine on the north side.

No. 1 level is 300 feet deep. The western cross-cut is 109 feet long to where the No. 1 reef is cut, and the total length of the cross-cut is 140 feet from the shaft. At the shaft the country dips west, and the anticline should be a little to the east of the shaft.

The southern level from the cross-cut is extended on the reef for 188 feet to the south boundary of the lease. The walls of the reef here are about 15 feet apart, and on the eastern wall there is about 2½ feet of quartz and slate, and on the western wall there is a similar thickness of crushing material. The walls dip west. At the end of the southern level the reef is 7 feet thick. In the northern cross-cut No. 1 reef, for a length of 60 feet, averages 1 foot thick.

No. 2 level is 400 feet from the surface. The eastern cross-cut is 140 feet long, and passes through beds dipping east. A leader was cut at the end of the cross-cut. In the western cross-cut, at 108 feet from the shaft,

No. 1 reef was cut; strike N. 20° W. The shaft is in an anticline. At this level the beds dip east on the east side, and to the west on the west side of the shaft. The angle of dip is low. At 81 feet, in the western cross-cut, a syncline occurs.

The mine generally looks well.

The manager informs me that 1,400 tons of quartz has been crushed for a yield of 1,093 oz. of gold.

The following analysis of a sample of the dyke rock from the Golden Bar Extended mine has been made in the geological laboratory by Mr. P. G. W. Bayly:—

	per cent.
SiO_2	41.65
Al_2O_3	15.85
Fe_2O_3	1.29
FeO	8.90
MgO	7.82
CaO	7 39
Na_2O	1.07
K_2O	2.41
H_2O + (above 110 deg. C.)	4.63
H_2O − (at 110 deg. C.)	0.45
CO_2	6.36
TiO_2	1.65
P_2O_5	0.25
SO_3	Nil
Cl	Trace
MnO	0.20
NiO	0.04
CoO	Trace
Li_2O	Trace
	99.96

The CO_2 per cent. is high, and probably indicates decomposition.

[*9.8.08.*]

HUON'S HILL, WODONGA.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

About 3 miles easterly from Wodonga on Huon's Hill, and 1,280 feet above sea-level, there are reef workings. Old dumps indicate that many years have elapsed since this reef was first opened up, and recently another shaft has been sunk and several shallow openings made along the outcrop, besides which a crushing of 10 tons of quartz was taken out from the main shaft. This yielded 30 oz. 12 dwt. of gold, worth £3 17s. 4d. per oz.

The country rock is mica schist with outcrops of granite rock on Huon's Hill. Where the reef crops out the country is decomposed granite rock,

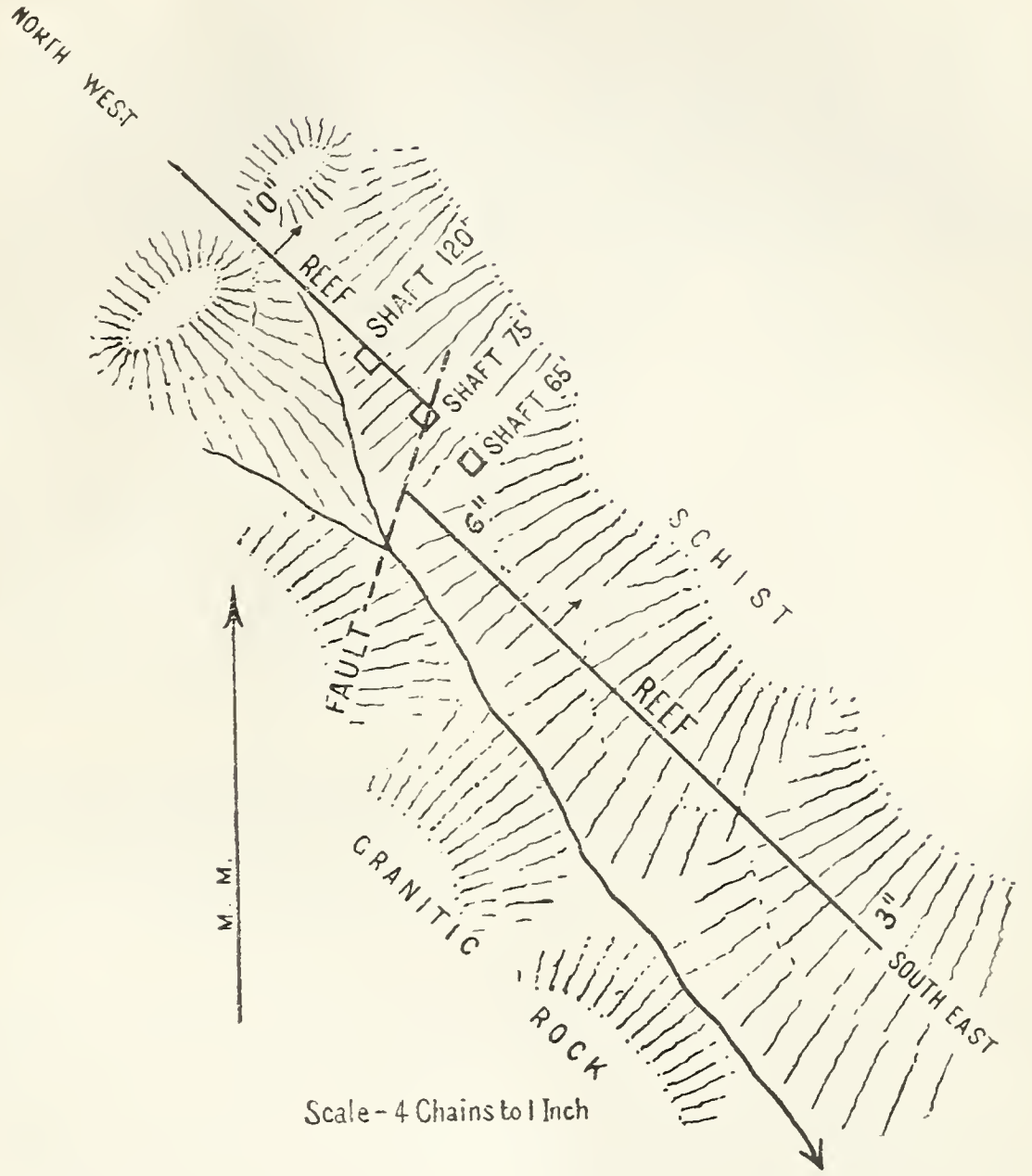


FIG. 36.—Plan showing Reef at Huon's Hill.

with mica schist close by. The reef ranges from 4 inches to 6 inches thick, occasionally thickening out to 1 foot or more. The quartz is of dull yellowish colour and contains much iron pyrites. The strike of the reef is north-west, the dip north-east at 50°. The main shaft is 75 feet deep and is on the east side of a fault which throws the south-east end of the reef about 1 chain to the south-west. The shafts are sunk to cut the reef on the dip; they are close to the junction of the granite rock and the mica schist, so that the reef so far stoped out has been in granitic country; but by following the reef further on its dip it will be in mica schist country. From the main shaft the reef has been traced for about 10 chains to the north-west by shallow shafts and costeans. South-east from the main shaft the reef can be traced for 5 chains. It attains a thickness of 1 foot on the saddle north-west from the main shaft. One chain north-west of the main shaft is an old shaft 120 feet deep, from which a great deal of work appears to have been done.

[*28.2.08.*]

THE WALLABY AND RECHABITE REEFS, HURDLE FLAT, NEAR BEECHWORTH.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The Wallaby reef is on the west bank of Nine-Mile Creek, about 1 mile higher up than Rocky Point, and 6 miles in a direction a little south of east from Beechworth. The top workings of the mine are 1,970 feet above sea-level by aneroid measurement, and the bottom tunnel is about 1,820 feet above sea-level. On the top of the hill is a great excavation, 150 feet in depth and over 100 feet in length at the surface, and 30 to 40 feet wide, tapering in at the bottom. Many thousands of tons of quartz and mullock must have been crushed from this huge quarry. The general features are that a belt of country rock, penetrated by numerous veins of auriferous quartz, has been faulted in blocks. The general strike of the altered Ordovician beds is about N. 10° W., and faults that run nearly east and west have severed the belt. The faults have a general southerly dip, and have thrown the blocks to the east, going south. Besides the Wallaby Reef, which is the most northern of these blocks that has been worked, there are other minor workings on other blocks, such as the Marco Polo and the Kingston, and possibly the Rechabite Reef on the east side of the creek. The soil is red.

It is evident from the workings that a great deal of payable stone was obtained, but the method of working, by which each spur and vein of auriferous quartz was followed until it ran out or became poor, was unsuitable for this class of occurrence. The pitch of the shoots is to the south.

The Rechabite outcrop was a few feet above creek level, and is reputed to have been extremely rich. The shoot pitches south at about 20°; the strike of beds is N. 10° W.; and the dip, 75° W. The shoot was worked underfoot, but to what extent is not known. An adit was also carried southerly into the hill for 100 feet, and the auriferous quartz and mullock was stoped for a width of 12 feet and to a height of 80 feet above the floor of the adit.

The country on the east side of the creek is well settled, and the locality is suited for economical working, and hundreds of feet of backs could be gained by continuing the workings southward. The Rechabite is more to the east than the Kingston workings on the west side of the creek, but is probably the continuation of the same belt of auriferous country. If so, the continuation of the rich shoots worked on the west side of the creek at the Wallaby, &c., would be deep underfoot at the Rechabite, if they continue.

On the Wallaby side of the creek there are two tunnels driven into the hill just above creek level. One into the Kingston workings opens out into a large quarry, in very hard rock seamed with spurs. In this quarry a whim was erected, and a shaft sunk 80 feet below the tunnel level. The spurs and rock removed for crushing were about 8 feet wide. This shaft requires to be pumped out, and the old workings to be explored and prospected.

Three chains lower down the creek, and a few feet higher in level, is the Wallaby tunnel, and just below the tunnel is the remains of the old battery which has been burnt by a bush fire. The Wallaby tunnel is 600 feet long, and runs into the large open workings already noticed. A southerly branch from this tunnel is being driven into new country, and a little gold has been met with.

The hill should be carefully tested by a small battery, especially with a view to proving whether the crushing material could be taken in a face, for if this could be done very low-grade ore would be profitable to work, and the great bulk to be treated would probably justify a large battery. Water power could be availed of for some months in the year, and steam could be used for the balance. Fuel is abundant close by. This locality is one of the most promising for reefs in the neighbourhood of Beechworth, as they have already produced a great deal of gold and they are of persistent character. They offer a favorable field for further exploration.

[*25.6.08.*]

REEFS NEAR YACKANDANDAH, BEECHWORTH DISTRICT.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The Queen Elizabeth Reef.

This reef is situated on the south side of Long Gully, about 5 miles in a south-westerly direction from Yackandandah and 1,500 feet above sea-level. Trenches show the reef low down the slope of the hill, and it is proved for a length of about 300 feet. At the north end the reef is 8 inches thick, and the country rock consists of grey and yellow slate and sandstone beds of Ordovician age : the soil is red. The strike of the beds is N. 15° W. at the north end, and nearer the top of the hill, at the south end of the workings the strike is N. 8° W. The reef appears to conform to the strike of the beds. There are three shafts sunk on the reef, which is faulted and thrown short distances to the eastward going south. The northern shaft is about 15 feet deep, the middle shaft 18 feet deep, and the most southern shaft 20 feet deep. In the southern shaft the reef is small, from a thread to 3 inches thick, but widening in some places to 9 inches. The dip is about vertical. The top of the hill is about 1,650 feet above sea level, and the reef has been traced for 200 feet south of the top shaft. Three shoots of gold are proved in the three shafts. The work so far done is encouraging, and although the reef is small it could be worked at a low cost.

The Relay Reef.

On the eastern side of the ridge on which the Queen Elizabeth reef occurs, and about 4 chains east of it, is the Relay reef. This was worked a long time ago, and a shaft 80 feet deep was sunk at the south end of the outcrop, and the shoot of auriferous stone was worked down to that depth. The strike of the reef, which coincides with that of the country, is N. 10° E., dip vertical. The country rock consists of pink and yellow slates and sandstones. The reef is solid quartz from 1 foot to 3 feet thick. One chain north of the old shaft a new shaft has been sunk to a depth of 40 feet.

At the bottom of the new shaft a drive has been put in 40 feet to the south, and a reef from 1 to 2 feet thick is disclosed. The country is easy to work. At 10 feet south of the shaft a fault cuts off everything; the fault throws the reef west going north, and this part of the reef has not been recovered.

About 8 chains further south than the top of the hill over which the Queen Elizabeth reef runs, this same reef is exposed. The quartz is from 8 to 22 inches thick: strike N. 15° W. Two chains further west of where this same reef crosses the first gully south of the hill, a small reef 9 inches thick has been opened and found to carry a little gold.

The Struck Oil Reef.

The Struck Oil reef has been opened up about half-a-mile S. 30° E. from the hill crossed by the Queen Elizabeth reef; it is probably a continuation of that reef. The country consists of soft yellow and grey slate and sandstone, and the soil is red. The strike of the country N. 20° W.; dip 80° W.; pitch north at about 8°; thickness of quartz from 1 to 10 inches. An open cut has been made along the reef for 30 feet. The quartz yields about 1 oz. per ton. About 1½ chains to the west of the Struck Oil reef, and in similar country, is a parallel reef just opened up, the Sneezer. It is from 1 to 4 inches thick, dips 80° W., and a crushing yielded 1 oz. of gold per ton.

Fletcher's Reef.

One mile south from the Queen Elizabeth is Fletcher's reef. Strike N. 15° W.; dip nearly vertical, but slightly to the west; the quartz is from 1 to 6 inches thick, and a little gold is showing. A shaft has been sunk 35 feet deep, and it has been opened for a length of 150 feet at the surface. The country consists of pink and yellow slates and sandstones, and the soil is red. Clear Creek flows about 8 chains east of the shaft.

The Tin Tub Reef.

One quarter of a mile southward from Fletcher's reef is the Tin Tub reef. Forty years ago a shaft 30 feet deep was sunk here, but the shoot of gold was missed. A new shaft has been sunk 35 feet deep. The reef is from 1 inch to 9 inches thick, and dips to the west at 50°. The shoot of auriferous quartz pitches south, and has been proved for 70 feet in length. Mr. Roper crushed 5 tons from this reef for a yield of 21 oz. of gold. The country consists of yellow and grey slate and sandstone, soft for working, and the soil is red.

The Queen Bee Reef.

This reef, which is being prospected by Mr. I'Anson, is 6½ miles, a little west of south, from Yackandandah. It is half-a-mile in a southerly direction from the Tin Tub reef; and is being worked at an old garden site. The surface along the reef has been opened up for 100 feet in length, but at a depth of 15 feet a nearly horizontal fault cut off the reef. From the surface to this fault the quartz was profitable to work. By driving 31 feet east the portion of the reef below the fault was recovered. The thickness of quartz varied from 3 inches to 22 inches. So far the auriferous shoot worked above the fault has not been picked up below it. The country consists of grey and yellow decomposed slates, and the soil is red. Mr. I'Anson has another prospecting site one quarter of a mile to the west.

From the Queen Elizabeth to the Queen Bee reef the several prospecting sites are on the same belt of Ordovician country, and in this belt there appear to be two or three parallel lines of reef. For the most part the quartz is thin, ranging from an inch to 9 inches thick on an average, but

the auriferous shoots are well worth working, and the locality promises well, and is well deserving of further prospecting. It is as yet premature to think of installing a battery, but if the present prospects continue, when some further opening up of the several sites has been done, a battery will be needed.

For economical crushing and mining this tract has special facilities, as water power can be utilized for crushing purposes, and mine timber and fuel are abundant. The effort being made to open up these reefs deserves every encouragement.

[*26.6.08.*]

THE DARLING GRANT REEF, GRANITE CREEK, NEAR MYRTLEFORD.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

The Darling Grant reef is on Granite Creek and about 8 miles north-easterly from Myrtleford. The surrounding rocks are metamorphosed Ordovician, and granite outcrops a short distance to the northward. The strike of the beds is about N. 15° W. and their dip is westerly at 80°. The surface soil is red. Where the reef was worked at the south end, the foot-wall was softer than the hanging-wall. The strike of the reef is N. 10° E., dip 70° W. From this southern block a considerable quantity of quartz has been removed and it is said to have given a good return. A short tunnel has been driven below the open workings and quartz stoped out below, but to what extent could not be determined. The shoot of quartz appears to have pitched northwards. The block was about 130 feet long and is cut off by a fault at the northern end, and then the continuation was thrown about a chain to the north-west, where the second block was worked for 1 chain in length. The reef was from 1 to 2 feet wide and was stoped to over 100 feet in depth. The strike of this part of the reef is W. 20° N. From both the blocks worked the surface has been sluiced for some distance down the hill, showing that a considerable quantity of gold was shed from the reef. The height of the top workings above sea level is about 1,470 feet.

With the object of cutting the shoot of auriferous quartz at a lower level, a tunnel (cross-cut) was driven in from the north-west at 250 feet below the top workings. At 600 feet a wall striking W. 20° N. and dipping 70° S. was cut. This wall corresponds to the wall of the second block of quartz in the top workings, but there was no quartz on it. The wall was driven on for 60 feet in a westerly direction and was then lost in broken country; easterly the level was continued along a good wall for 75 feet where it is cut off by a fault; this fault should have been followed in a northerly direction until the wall was again struck, probably less than 100 feet along the fault. Instead, the level was driven 200 feet through the country rock in a south-westerly direction nearly parallel to the wall, and turning easterly towards the end, but without any result, as neither the reef nor its channel was cut.

The conditions that prevail here scarcely warrant further prospecting, but should further work be undertaken it should be in a northerly direction along the fault which at 75 feet from the end of the tunnel cuts off the wall.

[*24.6.08.*]

THE OVENS AND BUCKLAND RIVER VALLEYS.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

In all the river valleys of the North Eastern District of the State such as those of the King, Buffalo, Buckland, Ovens, Kiewa, Mitta Mitta and Murray Rivers, terraces occur that attest the oscillations of the land in relation to sea-level.

The Ovens Valley, near Myrtleford.

There has been a succession of alternate uplifts of the land and subsidences. During the uplifts denuding influences prevailed and valleys were scooped out, and during the periods of subsidence these

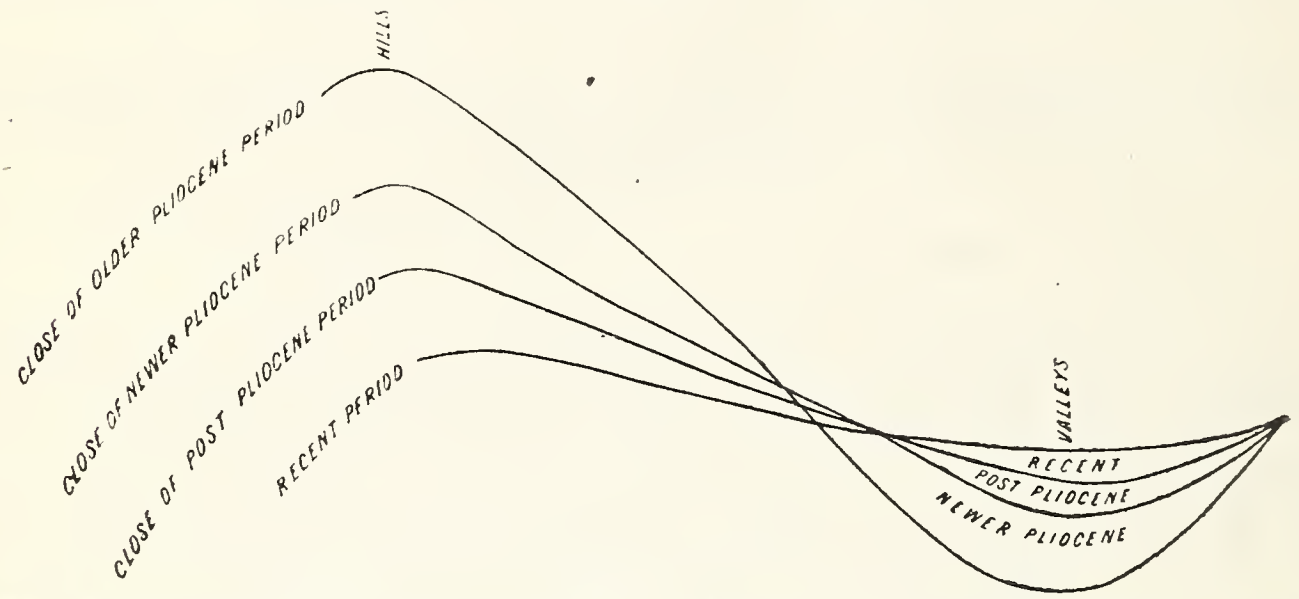


FIG. 37.—Diagram illustrating the cross-sections of the Ovens valley at several periods during its evolution.

valleys were again partly filled in. When the uplift was greatest as compared with sea-level then denuding agencies were most effective and during that time (apparently about the commencement of what is known as the Newer Pliocene period) valleys were worn to their greatest depth in the Ordovician and other old rocks. In the hills there is evidence of older Tertiary leads that extend back to Miocene times, as in the case of Mount Fainter at the head of the Kiewa valley, but these very ancient Tertiary drifts are not known in the Ovens River valley. A reaction appears to have set in, and the relative position of the land and sea was so altered by subsidence that drift material accumulated in the valley and filled it up for 250 to 300 feet in depth, burying the old river gravels (some of them auriferous) to that depth. This material is considered to be of Newer Pliocene age. Again an uplift of the land took place, with the result that the valley was worn down in the Newer Pliocene material to a depth of 50 or 60 feet. leaving remnants along the foot of the hills skirting the valley. The uplift was arrested and succeeded by a subsidence, during which about 20 feet of Post-Pliocene drift-material was laid down. Once more an uplift occurred, and a valley was cut in Post-Pliocene drift; then another subsidence followed, and 10 to 15 feet of Recent drift was laid down, and this forms the present surface, the tendency being to cut away this material rather than to add to it.

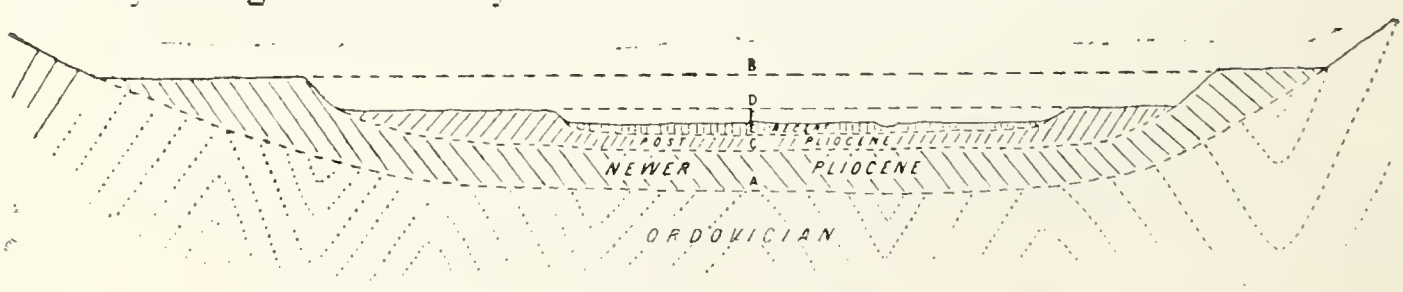


FIG. 38.—Section showing the alluvial deposits in the Ovens valley.

It is noticeable that the extent of the denudation here appears to have been greater in the past than at present, as the valleys were scooped out more deeply, and a greater depth of drift accumulated in Newer Pliocene times than in the Post-Pliocene period, and greater in the latter period than in Recent times.

The obvious reason is that the mountains were formerly higher and therefore condensation of moisture was greater and the slopes steeper, hence denudation was greater in the valley, and the hillside furnished more material again to fill up the valley when the period of subsidence took place. As the relative heights of the hills and valleys diminished, so did the work of excavation and of filling up of the valleys become less, and this may be expected to continue. Apparently the oscillations caused by uplifts and subsidences have correspondingly diminished.

Possibly the cause is that the oscillations of level are becoming less marked, and this has influenced the power of the water to excavate during periods of uplift and also its power to fill up the valleys during subsidences.

[*5.10.09.*]

The Buckland Valley.

The Buckland River rises on the northern slope of the Divide, between Mt. Selwyn and Mt. St. Bernard. From its source it flows in a northerly direction for a length of about 23 miles to where it joins the Ovens River. Throughout its course it runs over Ordovician rocks (beds of slate and sandstone), but on its western side and within its watershed is a portion of the granite mass which forms the Buffalo Mountains. At 16 miles above its junction with the Ovens River, the Buckland divides into east and west branches, the eastern branch being the principal one. On the spur between these branches some of the reefs have proved to be auriferous.

At the lower end the valley is over a mile wide, but it contracts as the stream is followed up, and above the junction there are no wide flats. The mountains on each side of the valley rise to 1,500 or 2,000 feet above the river-level, and, in the case of the Buffalo Mountains, to as much as 4,500 feet above that level. The most striking feature of the valley is the vast amount of rock material that has been removed by the stream. The remaining mountains enable this to be gauged. Only by continuous action through cycles of time could such a work be accomplished by such means.

At the period of greatest erosion the Buckland Valley was bared right down to the rocky bottom that underlies the present terraces and flats of alluvial material. Then a period of accumulation set in, and gravel, sand, and soil covered the bare rocky floor of the valley, and richly auriferous gravel was deposited along the course of the stream; it must have been at this stage and previous to it that the rocks highly productive of gold were being denuded and their gold concentrated in the stream bed, associated with pebbles of those rocks which were seamed with gold-bearing veins. Alluvial material accumulated to the height of the top of the terraces, which are in places over 100 feet higher than the present river-level. Another epoch of erosion set in after the terraces were deposited, and since that period they have been deeply cut into and the Recent alluvial flats have since been formed.

There is no evidence in the upper portion of the valley of Tertiary deposits. The terraces are probably of Post-Pliocene age. In the lower portion of the valley, where it joins the Ovens River valley, Tertiary deposits most likely occur, but there are no shafts or bores to prove this. The drift deposits above the old auriferous lead, which runs down the valley to within a couple of miles of the junction of the rivers, does not carry much gold, but the Recent gravels along the course of the stream were rich in gold, especially where they were enriched by the stream cutting through the old lead.

It is a striking feature that there are no lateral feeders of the alluvial gold gravels from either the east or west sides of the valley until the Junction or Upper Buckland is reached. At this point both branches of the stream have been worked for alluvial gold. The deduction is that the alluvial gold right down the valley has been transported from a source higher up the river than Upper Buckland. What little reefing has been done commences at the junction of the two branches of the river and continues southward, but auriferous quartz mining has never assumed important dimensions even there, and this poverty in productive quartz reefs leads to the inference that denudation has long since swept away the zones of Ordovician rock which supplied the abnormally rich alluvial deposits of this valley with gold.

Gold workings began about 1853 at the Buckland, and as a field it was noted for splendid and regular yields. It was worked by sluicing, &c., for half a century, but now, except for dredging, only a few fossickers are left. The dredging industry will continue for a few years longer and then this valley will practically cease to contribute to the annual gold yield. For agriculture and fruit-growing it is well adapted, and the abundant supply of water could be converted into power most readily

Mr. Easton has completed a survey of this valley.

[*23.7.09.*]

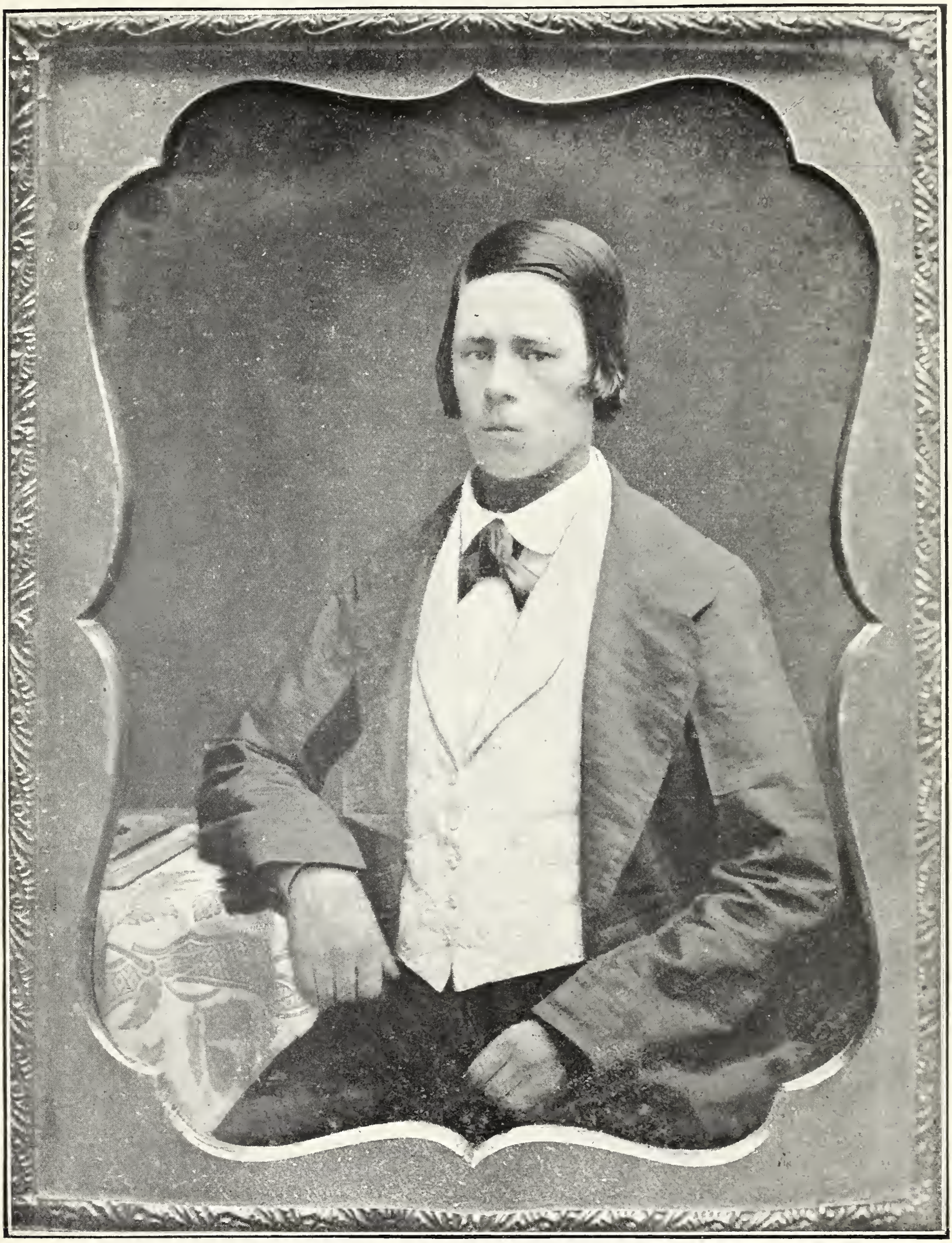
REMINISCENCES OF THE EARLY DIGGINGS.

The following notes were taken by Mr. E. J. Dunn, late Director of the Geological Survey, during conversations with some of the early pioneers :—

The First Discovery of Gold at Hiscocks, near Buninyong.

I was born in London on 8th July, 1832, came to Australia in February, 1849, remained in Melbourne for some months, came to Buninyong on 15th May, 1850, and lived near Mr. Hiscocks' blacksmith's forge. On the 2nd August, 1851, Thomas Hiscocks sen., Thomas Hiscocks jun., Edward Thomas, and myself set out to search for a stray cow belonging to Mr. Hiscocks sen. We spread out near where the Buninyong cemetery now stands. Mr. Hiscocks sen. went up the hill, the others remaining in the gully. Shortly afterwards there was a cry from Mr. Hiscocks, "I've got gold at last." We did not believe this until he brought down a piece of quartz 6 or 8 inches across, which was splashed over with gold. The next day we went to the same spot and found

Plate XLV.



MR. JOHN STOKER THOMAS.

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some more gold. The exact site where the gold was found is now occupied by the Imperial battery. On the third day we took milk dishes and washed the surface soil from round where the first auriferous quartz was found. After washing for some days Mr. Hiscocks and his son took the gold (about 2½ oz.) to Geelong and sold it to Mr. Patterson, goldsmith. Mr. Patterson said this was the first gold sold in Victoria. We continued digging, working the ground we chose. There were no claims marked out, nor any boundaries to the ground being worked. We got a few dwt. per day, and when we obtained pieces of quartz containing gold we crushed them up. The gold was shotty, but not waterworn. About three weeks after this, gold was discovered at Ballarat, and the diggers soon began to arrive in great numbers. This is an accurate account of the incident that led up to the gold discovery in this district.

At the Old Eureka Lead there was a party of gentlemen known as the Great Britain Party, as most of them came out in the ship *Great Britain*. We were mining on this rush, and this party who were the original prospectors washed over 56 lb. weight of gold out of a tub in which the dirt had been puddled. The sinking was about 20 feet deep.

About 1852 or 1853 my brother and myself kept stores in Ballarat, at Smythesdale, and other places. The chief store was at Buninyong. The prices that ruled were as follows:—Flour, £20 per bag of 200 lb.; sugar, 1s. per lb.; bread, 5s. 4-lb. loaf; butter, 6s. per lb.; eggs, 12s. per doz.; tea, 5s. per lb.; potatoes, 6d. per lb.; oats, 20s. per bushel; salt, 9d. per lb. Gin was 20s. per bottle, and ale 5s. per bottle.

JOHN S. THOMAS.

Buninyong, 9.9.09.

REMINISCENCES OF THE DIGGINGS AT BEECHWORTH AND OMEO IN 1853.

In 1853 I worked at Reid's Creek, Beechworth, with John Strickland, Bob Bow, Ash Kaine, and Alan Kaine, Brandy Jack, and the rest. Altogether there were eight members of the party. It was at the time when the man was shot in a paddock through the accidental discharge of a policeman's musket. We had a claim above the old crossing, and the claims were 12 feet square, with a wall of 2 feet around which was allowed. The depth of the ground was about 12 feet, and the wash dirt about 1 foot thick on soft granite bottom. From the wash dirt of this claim we obtained about 50 lb. weight of gold. The whole claim was worked out in about a week. The water was baled out by buckets. There were 400 to 500 people there. We obtained about £3 10s. per oz. for the gold. Shovels cost £1 each, and picks the same. Flour was £20 per 200-lb. bag. Tea was 10s. per lb., and sugar 2s. 6d. per lb.; matches, 1s. per box; tobacco, 10s. per lb. We stayed for five or six weeks altogether, but could not get another good claim. I left my mates and went to Spring Creek in the same locality, and was digging at the foot of Red Hill, and commenced sluicing there. We employed eight men and paid them £1 per day. We made from £30 to £40 per man per week by working the old and new ground together. Just below Tidyman's, near the Great Britain store, kept by Hempel, in the blue wash very good returns were got, as much as 2 to 3 lb. weight of gold per load. At Roper's Hill, near the Chinese camp, the sinking was 40 feet deep, and very rich returns were got. As much as 30 to 40 oz. was washed out in the morning by Eccles and party. This would be for about a couple of loads washed in "long toms." Madman's Gully was shallow, from 4 to 10 feet deep, and claims 12 feet

square. From such claims 13 to 20 oz. was obtained. We remained about three months at Red Hill, and then bought horses and started on a prospecting trip, and in about four or five weeks reached Omeo, East Gippsland, and camped on the swamp on Livingstone Creek, as now known. We went out on the plains. There were eight in the party, Miller, Dean, Love, Beefy and Little Beefy, Jimmy Bloomfield, Pike, and myself, and we saw a bullock and killed him, not knowing that there was any settlement near. While killing the bullock, Tom Sheen and Joe Day rode up, and informed us that we were at Omeo. This was in 1853. They would not take payment for the beef, but helped us skin the beast, and told us to make for their hut and stockyard, up the Morass Creek. We were camped on the Morass Creek for some five or six weeks, and prospected around, and obtained a little gold, but not payable. We then went over and put down a paddock in the swamp by means of a sapling-lined shaft, got a little gold, but could not master the water. We went further up Livingstone Creek, and started prospecting just below the present township. The sinking was about 12 to 14 feet, and we obtained about 40 oz. of gold per day on an average. Part of the men were always away procuring provisions. We used to go to Port Albert for provisions, such as flour, &c., which were brought by a small vessel from Tasmania. This was the first gold found at Omeo.

We built a log cabin, and put up a water-wheel, and cut a tail race, and we stayed here for about ten months. Three months after finding gold we went to Yackandandah to get provisions, tools, and outfit. On our return twenty to thirty miners came back with us, and later on quite a rush set in, and from 200 to 300 men were at work there before we left for Monaro. Gold brought £3 12s. per oz. At first the Omeo gold was sold in Beechworth for £4 per oz., but the storekeepers who got this price had to refund.

On one trip coming back from Port Albert we escaped Tongio Hill by coming up Swift's Creek (now so called), and had a blackfellow for a guide. Blacks were numerous at Omeo then. We prospected this creek later on. There were three of us, and we set in near the present Tongio West township. The sinking was about 14 feet deep, and the washdirt from 4 to 5 feet deep. We made about 3 to 4 oz. of gold per man per week. Then a rush set in from Omeo. This was the first gold got in Gippsland.

JOHN T. REID.
25.6.08.

Mr. Reid came from California in 1851, and is now 77 years of age.—E.J.D.

MINING IN THE FIFTIES AT SPRING CREEK, BEECHWORTH.

James Elder McKay, miner, of Hastings, states that he was at Spring Creek, Beechworth, in 1853, and gave the following particulars about the field at that time:—The claims ranged from the surface to 40 feet in depth, and the washdirt was from 1 to 3 feet in thickness, with sandstone, pipeclay, and granite bottom. The washdirt ranged from 2 oz. to 20 oz. of gold per load. Two brothers, named Smith, camped near me, obtained 32 oz. of gold to one dish of dirt off the bottom, and

84 oz. altogether for the week's work from two loads of washdirt. Tub and cradle were much in use, also the long-tom, with ripples at the end. Near the Spring Creek Falls there were rich crevices, and there was also a very tough clay that was rich in gold, but it needed a great amount of puddling to dissolve it. This clay gave 2 oz. of gold, and more, to the tub. On one occasion we washed over 12 oz. of gold in one dishful of wash off the bottom. The gold was most plentiful directly on the bed-rock; it was mostly fine, and seldom exceeded ½ dwt. in weight. Pieces up to ½ oz. were occasionally found. The Sunday Reef, One Mile, was one of the first reefs discovered; there was a good deal of surface gold about this reef. Then some others were found at Rocky Point and at Hurdle Flat. In January, 1854, the Buckland was discovered by some Canadians, and very rich yields were obtained. In one case, in a square yard of ground, 100 oz. of gold was got.

At the end of 1853 I was mining at Reid's Creek, and I knew of one paddock, 8 feet square, opposite Knight's Hotel, that was sunk by means of slabs to a depth of 12 feet. Several men were at work on this, and the ground was very wet. By means of buckets and whips the ground was drained while the sinking was being done. The washdirt was over 2 feet thick, and streaks of gold and black sand could be seen through the wash. From the bottom, 68 lb. weight of gold was obtained. The gold was got by cradling; it brought £3 14s. per oz. Bread was selling at 5s. per 4-lb. loaf, and potatoes were 2s. 6d. per lb. Cabbages were sold at 2s. 6d. each; eggs were 20s. a dozen; milk was 2s. 6d. per quart; flour was £12 per bag; and a bushel of oats cost £2. Long-handled shovels were £1 each; and picks 10s. each. Planks for sluice-boxes were 2s. 6d. per lineal foot. The whole of Reid's Creek was being worked from falls to falls, and for some width. There were 500 to 600 people at work there at this time. The blacks used to come from the Mitta Mitta and Little rivers and sell opossum skins sewn into rugs with sinews. They carried the usual spears, boomerangs, &c. At the latter end of 1853, two parties of Californians were at work in Sydney Flat. This was more than a year before Johnson opened his paddock on the Woolshed. Cameron, Lonie, Chandler, Strickland, Bartey, and Dryburgh assisted Johnson to get down to the washdirt. The paddock was worked down by benches, and with buckets and whips. Johnson took up eight men's claims, and the others took up claims up and down the creek. Wages at this time, on Reid's Creek, were £7 to £8 per week.

Silver Creek was opened up a little before the Woolshed, and the sinking was from 12 to 18 feet in depth. Rich yields of gold were obtained. Deep Creek was opened up a little later, and the sinking was 20 to 23 feet deep. The claims were 20 feet square per man, and up to £500 to £600 worth of gold was obtained from these claims.

At Reid's Creek, the black sand (cassiterite) was difficult to separate from the gold, the only method known at this time was to pan it off in a dish, and then the gold was not thoroughly separated from the tin ore, and it is known that as much as 80 oz. of gold was obtained from a ton of the black sand from which the gold had been panned.

James Elder McKay,
3·9·07.

REPORTS ON GRAPTOLITES.

No. 11[1].

By T. S. Hall, M.A., D.Sc., Melbourne University.

A.—From Steiglitz District.

Collected by W. H. Ferguson.

Nos. 6095-6212.

Field number 23 S.Z. Seven chains, bearing 260° from the angle on the west side of the Steiglitz-Moreep road, parish of Moreep, with bearings 229° 6′ and 206° 11′.

Didymograptus nitidus.
Didymograptus cf. *extensus.*
Didymograptus caduceus (very common).
Tetragraptus bryonoides.
Phyllograptus cf. *typus* (1 example).

Horizon, middle of the Castlemaine series.

Nos. 6213-6248.

Field number 24 S.Z. From the south-west corner of the Steiglitz State School allotment, parish of Durdidwairah, bearing 270° for 5 chains.

Didymograptus sp. (1 example).
Didymograptus caduceus (very common).
Dichograptus sp. (fragments).
Diplograptus sp.

Horizon, Castlemainian; probably just above previous locality.

Nos. 6249-6286.

Field number 25 S.Z. Sailor's Gully. From the south-west corner of the Steiglitz cemetery, parish of Durdidwarrah, bearing 205° for 110 chains.

Didymograptus caduceus (extremely common).
Tetragraptus serra (1 example).
Diplograptus sp. (2 examples).

Horizon, Castlemainian; same as previous locality.

Nos. 6287-6316.

Field number 26 S.Z. From south-west corner of State school allotment, Steiglitz, parish of Durdidwarrah, bearing 180° for 2 chains.

Didymograptus cf. *extensus* (1 example).
Didymograptus caduceus (common).
Tetragraptus serra (1 example).
Tetragraptus sp. (1 example.)
Loganograptus logani (1 example).
Phyllograptus cf. *typus* (2 examples).

I have never found *Loganograptus logani* and *Phyllograptus* cf. *typus* associated. In fact, at Castlemaine, a zone, which I called the *Didymograptus caduceus* zone, separates the zone in which these species occur.

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[1] For other reports on Graptolites see Progress Rept., Geol. Surv. Vict., No. 9, 1898, p. 126 (reprinted with some corrections *ibid*, No. 10, p. 102); Monthly Prog. Rept., Geol. Surv. Vict., Nos. 6 and 7, 1899, p. 13; Records, Geol. Surv. Vict., Vol. I., pts. 1, 3, and 4, Vol. II., pts. 1 2, and 4, and Vol. III., pts. 1 and 2.

I believe the identifications are correct as the specimens are in a fairly good state of preservation. The rock containing the two species appears to be the same in each case, and is a bluish slightly cleaved slate, in which the fossils are sometimes pyritic. As Mr. Ferguson is sure that no confusion of localities has occurred, I am uncertain as to the exact horizon, and further careful collecting is advisable.

Horizon, Castlemainian. Exact horizon doubtful.

Nos. 6317-6344.

Field number 27 S.Z. From the North Mariners shaft. From the north-west corner of the Steiglitz cemetery, parish of Durdidwarrah, bearing 225° for 85 chains.

Didymograptus bifidus (common).
Didymograptus caduceus (scarce).
Tetragraptus serra (? 1 example).
Phyllograptus cf. *typus* (common).

Horizon, Castlemainian, lowest zone.

Nos. 6345-6353.

Field number 28 S.Z. From the north-west corner of allotment 44, section A, parish of Durdidwarrah, bearing 350° for 10 chains.

Diplograptus sp. (several).

Horizon uncertain, but possibly Upper Castlemainian.

Nos. 6354-6361.

Field number 29 S.Z. From the north-east corner of Recreation Reserve, parish of Durdidwarrah, bearing 232° for 20 chains.

?*Diplograptus* sp. (1 example).
?*Lasiograptus* sp. (1 example).

The rock is a nodular slate, and the specimens are very indistinct. Horizon, very doubtfully Darriwilian.

Nos. 6362-6392.

Field number 31 S.Z. From the north-east corner of the Recreation Reserve, parish of Durdidwarrah, bearing 220° for 17 chains.

Didymograptus extensus (1 example).
Didymograptus spp. (3 examples).
Didymograptus caduceus (2 examples).
Tetragraptus serra (2 examples).
Tetragraptus bryonoides (5 examples).
Phyllograptus cf. *typus* (common).

Horizon, Lower Castlemainian.

Nos. 6393-6402.

Field number 35 S.Z. From the north-west corner of Allotment No. 9, Steiglitz township, parish of Durdidwarrah, bearing 76° for 6 chains.

Didymograptus caduceus.
Phyllograptus typus.

Horizon, Lower Castlemainian.

Nos. 6403-6415.

Field number 37 S.Z. From Eclipse Creek, on east bank a few yards south of bridge, where road crosses creek at north end of Allotment 7, Section A, parish of Moreep.

Didymograptus cf. *extensus.*
Didymograptus nitidus.
Didymograptus caduceus (mostly large forms).
Tetragraptus serra (1 doubtful, 5-branched example).
Dichograptus octonarius (?) (1 example).
Diplograptus sp.

Horizon, Middle Castlemainian.

Nos. 6416-6421.

Field number 38 S.Z. From near rifle-butts, Sutherland's Creek, bearing 240° for 36 chains from north-west corner of Allotment 6, township of Steiglitz, parish of Durdidwarrah.

Didymograptus caduceus (small slender forms).
Phyllograptus cf. *typus.*

Horizon, Lower Castlemainian.

B.—From the Bendigo District.

Collected by H. S. Whitelaw.

Nos. 8286-8309.

Field number 49 Bo. From the Princess Dagmar shaft, 270° for 5.93 ch., thence 51° 30′ for 4.80 ch.

Tetragraptus fruticosus (all three-branched)
Phyllograptus cf. *typus.*

Horizon, Upper Bendigonian.

Nos. 8310-8349.

Field number 52 Bo. From Golden Age shaft, 188° for 2.86 ch., thence 259° 31′ for 2.93 ch.

Didymograptus extensus.
Didymograptus sp.
Didymograptus bifidus.
Tetragraptus bryonoides.
Tetragraptus serra.
Tetragraptus similis.
Phyllograptus cf. *typus.*

Horizon, base of Castlemainian.

Nos. 8350-8393.

Field number 38 Bo. From the intersection of the E. side of Don-street with the S. side of Mt. Korong-road, 165° 30′ for 7.56 ch.

Didymograptus sp.
Tetragraptus fruticosus (out of above forty specimens two have four branches, and the remainder have but three).
Tetragraptus quadribrachiatus.
Tetragraptus bryonoides.
Goniograptus macer.

Horizon, Bendigonian, towards the top of the series.

Nos. 8394-8439.

Field number 64 Bo. From the North Argus shaft, 196° for 1.70 ch., thence 142° for 3.15 ch.

Didymograptus n.sp., cf. *pritchardi.*
Didymograptus sp.
Didymograptus nitidus.
Didymograptus bifidus (very common).
Didymograptus cf. *extensus.*
Tetragraptus pendens.
Tetragraptus similis.
Tetragraptus serra (common).
Tetragraptus bryonoides (very common).
Tetragraptus quadribrachiatus.
Dichograptus sp.
Phyllograptus cf. *typus* (common).

Horizon, base of Castlemainian.

Nos. 8440-8475.

Field number 50 Bo. From Johnson's No. 1 shaft, 357° for 4.40 ch., thence 106° 30′ for 1.10 ch.

Didymograptus sp.
Tetragraptus fruticosus (three-branched, very common).
Tetragraptus bryonoides.
Tetragraptus serra.
Phyllograptus cf. *typus* (common).
Phyllograptus cf. *angustifolius* (?) (one specimen).

Horizon, Bendigonian, towards the top of the series.

Nos. 8476-8508.

Field number 37 Bo. From the intersection of the E. side of Bennett-street with the N. side of Victoria-street, 220° 45′ for 7.77 ch., thence 207° for 3.25 ch.

Didymograptus cf. *extensus* (one imperfect specimen).
Tetragraptus fruticosus (very common).

Horizon, Bendigonian, upper part of the series.

Nos. 8509-8535.

Field number 60 Bo. From the Virginia shaft, 298° for 1.13 ch., thence 316° for 0.73 ch.

Didymograptus nitidus (one specimen).
Tetragraptus fruticosus (three-branched, common).
Phyllograptus cf. *typus* (common).

Horizon, Bendigonian, upper part of the series.

Nos. 8536-8571.

Field number 54 Bo. From Johnson's Reef Ext. shaft, 171° 30′ for 2.28 ch., thence 215° 30′ for 3.88 ch.

Didymograptus bifidus (common).
Tetragraptus serra.
Tetragraptus bryonoides.
Tetragraptus similis.
Tetragraptus quadribrachiatus.
Phyllograptus cf. *typus* (two specimens).

Horizon, Castlemainian, base of the series.

Nos. 8572-8620.

Field number 30 Bo. From the intersection of the S. side of Havilah-road with the W. side of Reviere-street, S.W. for 0.82 ch. along Havilah-street, thence 330° 50′ for 9.92 ch., thence 54° 45′ for 4.21 ch.

Tetragraptus fruticosus (very common, all three-branched).
Tetragraptus pendens (1 doubtful specimen).
Tetragraptus similis (1 specimen).
Tetragraptus bryonoides (1 specimen).
Phyllograptus cf. *typus* (common).

Horizon, Bendigonian, near top of the series.

Nos. 8621-8647.

Field number 33 Bo. From the American shaft, 278° for 2.44 ch., thence 15° 30′ for 7.21 ch.

Didymograptus bifidus.
Didymograptus sp.
Tetragraptus similis.
Phyllograptus cf. *typus.*

Horizon, Castlemainian, base of series.

Nos. 8648-8701.

Field number 65 Bo. From the North Argus shaft, 196° for 1.17 ch., thence 281° 45′ for 8.60 ch.

Didymograptus bifidus (common).
Didymograptus extensus (1 specimen).
Didymograptus caduceus (3 small specimens).
Tetragraptus bryonoides.
Tetragraptus serra (common).
Tetragraptus similis.
Tetragraptus quadribrachiatus.
Phyllograptus cf. *typus* (common).
Clonograptus sp. (2 small specimens).

Horizon, Castlemainian, base of series.

Nos. 8702-8737.

Field number 5 Bo. From the intersection of the N.E. side of Anderson-street with the N.W. side of Valentine-street, 240° for 7.63 ch., thence 244° for 1.13 ch.

Tetragraptus serra.
Tetragraptus similis.
Tetragraptus quadribrachiatus.
Tetragraptus approximatus (4 examples).
Tetragraptus fruticosus (1 small example).
Phyllograptus cf. *typus* (1 example).

Horizon, Bendigonian, near base of series.

Nos. 8738-8776.

Field number 6 Bo. From the intersection of the W. side of Moran-street with the S. side of Havilah-road. 0.94 ch. along Moran-street, thence 96° 30′ for 7.4 ch., thence 202° 45′ for 4.95 ch., thence 112° 30′ for 1.28 ch.

Didymograptus sp.
Tetragraptus serra.
Tetragraptus bryonoides.
Tetragraptus clarkei.
Tetragraptus fruticosus (3 and 4 branched forms are about equally represented, and occur on the same slabs).
Tetragraptus approximatus.
Clonograptus sp.

Horizon, Bendigonian, low down in the series.

Nos. 8777-8837.

Field number 31 Bo. From the American shaft, 171° for 7.07 ch.

Didymograptus sp.
Didymograptus bifidus (1 doubtful specimen).
Tetragraptus fruticosus (very common and almost all are 3-branched).
Tetragraptus serra.
Tetragraptus bryonoides.
Tetragraptus similis.
Tetragraptus quadribrachiatus.
Phyllograptus cf. *typus* (very common).
Dichograptus sp. (1 specimen).

Horizon, Bendigonian, near the top of the series.

Nos. 8838-8882.

Field number 7 Bo. From the intersection of the W. side of Dowding-street with the N.W. side of Sandhurst-road, 175° for 5.97 ch.

Didymograptus sp.
Tetragraptus fruticosus (all apparently 4-branched).
Tetragraptus serra (1 doubtful specimen).
Phyllograptus cf. *typus.*
Bryograptus sp. (2 doubtful examples).

Horizon, Bendigonian, low in the series.

Nos. 8883-8938.

Field number 8 Bo. From the S.W. corner of Long Gully cricket reserve, 2.45 ch. along its S. boundary.

Tetragraptus fruticosus (very common, and all 3-branched).
Tetragraptus pendens (1 example).
Tetragraptus serra.
Tetragraptus similis (1 example).
Goniograptus sp. (a doubtful fragment).

Horizon, Bendigonian, towards top of series.

Nos. 8939-8964.

Field number 62 Bo. At the point of intersection of lines bearing 206° 20′ from Specimen Hill shaft and 347° from the Virginia shaft.

Didymograptus bifidus (1 doubtful example distorted by pressure).
Tetragraptus fruticosus (common, and all 3-branched).
Tetragraptus bryonoides.
Tetragraptus serra.
Dichograptus sp.
Phyllograptus cf. *typus* (common).

Horizon, Bendigonian, near top of series.

Nos. 8965-9010.

Field number 42 Bo. From the intersection of the S. side of Duncan-street with the E. side of Robinson-street, 265° 30′ for 1.60 ch.

Tetragraptus fruticosus (very common, and all 3-branched).
Tetragraptus bryonoides (1 specimen).
Tetragraptus serra (1 specimen).
Tetragraptus similis (1 specimen).
Tetragraptus quadribrachiatus (1 doubtful specimen).
Dichograptus octobrachiatus.

Horizon, Bendigonian, high in the series.

Nos. 9011-9043.

Field number 36 Bo. From the intersection of the W. side of Darby-street with the S. side of Mt. Korong-road, 309° 30′ for 2.73 ch., thence 358° 30′ for 5.06 ch., thence 330° for 5.59 ch.

Didymograptus cf. *extensus* (1 example).
Tetragraptus fruticosus (very common, and all 3-branched).
Tetragraptus pendens.
Tetragraptus serra.
Tetragraptus similis.
Dichograptus octobrachiatus (a doubtful example).
Goniograptus macer.
Phyllograptus cf. *typus* (common).

Horizon, Bendigonian, high in the series.

Nos. 9044-9081.

Field number 61 Bo. From the Virginia shaft, 298° for 1.13 ch., thence 360° for 4.10 ch.

Didymograptus bifidus (a doubtful example).
Tetragraptus fruticosus (very common, and all 3-branched).
Tetragraptus similis.
Tetragraptus serra.
Tetragraptus quadribrachiatus (1 example).
Phyllograptus cf. *typus* (common).
Clonograptus sp. (1 example).
Goniograptus macer (1 example).

Horizon, Bendigonian, near top of series.

Nos. 9082-9111.

Field number 57 Bo. From the intersection of the N.E. side of Crowther-street with the N.W. side of Market-street, 80° for 5.98 ch.

Didymograptus extensus (1 example).
Didymograptus bifidus (very common).
Didymograptus sp.
Tetragraptus bryonoides.
Tetragraptus serra
Tetragraptus similis.
Phyllograptus cf. *typus.*
Dichograptus sp.
Clonograptus sp.
Goniograptus macer (a doubtful example).

Horizon, Castlemainian, base of series.

Nos. 9112-9156.

Field number 29 Bo. From the intersection of the S.W. side of Buckley-street with the N.E. side of Bennett-street, 350° 30′ for 1.60 ch.

Tetragraptus fruticosus (very common, one example is 2-branched, the remainder are 3-branched).
Tetragraptus pendens.
Tetragraptus serra (1 example).
Tetragraptus similis (a doubtful example).
Tetragraptus bryonoides (1 example).
Phyllograptus cf. *typus.*
Dichograptus octobrachiatus.
Goniograptus macer.

Horizon, Bendigonian, high in the series.

Nos. 9157-9183.

Field number 32 Bo. From the American shaft, 171° for 7.07 ch., thence 121° for 2.74 ch.

Didymograptus bifidus (1 example).
Tetragraptus serra (1 example).
Tetragraptus quadribrachiatus (2 examples).
Phyllograptus cf. *typus* (common).

Horizon, either top of Bendigonian or base of Castlemainian.

Nos. 9184-9213.

Field number 28 Bo. From the intersection of the E. side of Bennett-street with the N. side of Bannerman-street S. for 0.97 ch.

Tetragraptus fruticosus (common, all 3-branched).
Tetragraptus serra (1 example).
Phyllograptus cf. *typus* (2 examples).

Horizon, Bendigonian, high in the series.

Nos. 9214-9257.

Field number, 39 Bo. From the intersection of the S.W. side of Darby-street with the S. side of Mt. Korong-road, 309° 30′ for 2.73 ch.

Didymograptus extensus (1 example).
Tetragraptus fruticosus (very common, all 3-branched).
Tetragraptus pendens (1 example).
Phyllograptus typus (1 example).
Dichograptus octobrachiatus.
Goniograptus thureaui (1 double example).
Goniograptus cf. *macer* (1 example).

Horizon, Bendigonian, high in the series.

Nos. 9258-9266.

Field number 46 Bo. From Windmill Hill trig. station, 221° for 1.20 ch.

Didymograptus extensus (1 example).
Tetragraptus fruticosus (several, 1 example 4-branched, the rest 3-branched).
Tetragraptus pendens (1 example).
Tetragraptus serra.

Horizon, Bendigonian, probably high up in the series. The 4-branched variety of *T. fruticosus* is generally indicative of a low horizon, but the three associated species are, I think, evidence of the beds being well up in the series.

Nos. 9267-9290.

Field number 46 Bo. Same locality.

Tetragraptus fruticosus (common, all 3-branched).
Tetragraptus pendens (1 example).
Tetragraptus similis (2 examples).
Tetragraptus serra (1 doubtful example).

Horizon, Bendigonian, high up in the series. This locality is apparently identical with the previous one, and, if so, the collection would go to show that *T. fruticosus*, 4-branched form, is rare on this horizon, and may perhaps be neglected.

Nos. 9291-9338.

Field number 44 Bo. From Windmill Hill trig. station, 159° 30′ for 6.08 ch., thence 162° 45′ for 3.54 ch., thence 258° 30′ for 2.10 ch.

Tetragraptus fruticosus (very common, one 4-branched, the remainder apparently all 3-branched).
Tetragraptus pendens.
Tetragraptus serra.
Tetragraptus quadribrachiatus (1 example).
Dichograptus octobrachiatus (1 example).
Goniograptus thureaui (1 example).

Horizon, Bendigonian, high up in the series.

Nos. 9339-9364.

Field number 45 Bo. From Windmill Hill trig. station, 159° 30′ for 4.54 ch.

Tetragraptus fruticosus (very common, one doubtful 2-branched, one 4-branched, and the rest apparently 3-branched).
Tetragraptus serra (1 example).
Tetragraptus similis (2 examples).
Phyllograptus cf. *typus.*
Goniograptus macer (one very doubtful example).

Horizon, Bendigonian, high in the series.

Nos. 9365-9397.

Field number 11 Bo. From the intersection of the W. side of Hill-street with the S.W. side of Tuff-street, N.W. along Tuff-street 6 ch., thence 244° for 2.69 ch.

Tetragraptus fruticosus (several, all 3-branched).
Tetragraptus serra (1 doubtful example).

Horizon, Bendigonian, probably high in the series.

Nos. 9398-9443.

Field number 9 Bo. From the intersection of the N.E. side of Anderson-street with the N.W. side of Valentine-street, 201° 30′ for 7.53 ch.

Tetragraptus fruticosus (4 examples, all 4-branched).
Tetragraptus approximatus (1 example).
Tetragraptus serra (1 doubtful example).
Tetragraptus quadribrachiatus (2 doubtful examples).

Horizon, Bendigonian, near base of series.

Nos. 9444-9489.

Field number 10 Bo. From the S.W. corner of Long Gully cricket ground, 4.76 ch. along the S. boundary.

Didymograptus cf. *extensus* (3 examples).
Tetragraptus fruticosus (all apparently 3-branched).
Tetragraptus serra.
Tetragraptus similis.
Tetragraptus pendens (a doubtful record).
Phyllograptus cf. *typus* (several).

Horizon, Bendigonian, probably high in the series.

Nos. 9490-9519.

Field number 12 Bo. From the intersection of the N.W. side of Praed-street with the S.W. side of Tuff-street 350° 15′ for 12.02 ch., thence 104° 45′ for 3.16 ch.

Didymograptus bifidus (a doubtful record).
Didmograptus extensus (a doubtful record).
Tetragraptus fruticosus (very common, all 3-branched).
Tetragraptus serra (a doubtful record).
Phyllograptus cf. *typus* (common).

Horizon, Bendigonian, near top of series.

Nos. 9520-9552.

Field number 80 Bo. From the angle in N. side of Nettle-street between Honeysuckle and Old Violet streets, 1.66 ch. E. along Nettle-street, thence S. for 0.55 ch.

Didymograptus extensus (a doubtful record).
Didymograptus nitidus (common).
Tetragraptus fruticosus (common, all 3-branched).
Tetragraptus pendens (common).
Tetragraptus serra.
Tetragraptus similis (several).
Phyllograptus cf. *typus* (common).
Dichograptus sp.
Clonograptus sp.
Goniograptus macer (very abundant).

Horizon, Bendigonian, near top of series.

Nos. 9553-9590.

Field number 71 Bo. From the intersection of the S. side of Williams-street with the E. side of McIntyre-street, 227° for 1.32 ch., thence 277° for 10.07 ch.

Didymograptus extensus.
Didymograptus gracilis.
Didymograptus nitidus (a single example).
Didymograpus spp.
Tetragraptus fruticosus (common, all 3-branched).
Tetragraptus pendens (common).
Tetragraptus serra.
Tetragraptus similis (1 example).
Tetragraptus quadribrachiatus.
Tetragraptus sp.
Phyllograptus cf. *typus* (1 example).
Goniograptus macer (very abundant).

Horizon, Bendigonian, high in the series.

Nos. 9591-9618.

Field number 72 Bo. From the intersection of the N. side of Barnard-street with the W. side of Don-street, W. for 1.30 ch. along Barnard-street, thence 180° for 0.52 ch.

Didymograptus extensus (common).
Didymograptus nitidus.
Didymograptus spp.
Tetragraptus fruticosus (very common, all 3-branched).
Tetragraptus pendens (common).
Tetragraptus serra.
Tetragraptus similis (1 example).
Phyllograptus cf. *typus* (very common).
Goniograptus macer.

Horizon, Bendigonian, high in the series. Same as last locality.

Nos. 9619-9640.

Field number 73 Bo. From the intersection of the S. side of Nettle-street with the E. side of Old Violet-street, E. for 2.89 ch. along Nettle-street, thence N. for 0.68 ch.

Tetragraptus fruticosus (common, and all but one 3-branched).
Phyllograptus cf. *typus* (3 examples).

Horizon, Bendigonian, high in the series. Data inadequate.

Nos. 9641-9684.

Field number 69 Bo. From the intersection of the S. side of Lilac-street with the E. side of Old Violet-street, E. for 2.19 ch. along Lilac-street, thence N. for 0.32 ch.

Didymograptus nitidus (2 examples).
Tetragraptus fruticosus (very common, all 3-branched).
Tetragraptus pendens (several).
Tetragraptus serra (2).
Tetragraptus bryonoides (2).
Tetragraptus similis (1).
Dichograptus octobrachiatus (2).
Phyllograptus cf. *typus* (common).
Goniograptus macer (3).

Horizon, Bendigonian, high in the series.

Nos. 9685-9715.

Field number 76 Bo. From the N.E. corner of Belltopper Hill State school reserve, 110° for 0.40 ch.

Didymograptus bifidus (very common).
Didymograptus nitidus (1).
Didymograptus sp.
Tetragraptus pendens (1).
Tetragraptus similis (2).
Tetragraptus serra (5).
Tetragraptus quadribrachiatus (?) (1).
Phyllograptus cf. *typus* (1).

Horizon, Castlemainian, base of series.

Nos. 9716-9744.

Field number 78 Bo. From the intersection of the E. side of Vinton and the S. side of Turner-street, 302° for 6.44 ch.

Didymograptus bifidus (very common).
Didymograptus caduceus (?) (a very doubtful record).
Didymograptus sp.
Tetragraptus pendens (1).
Tetragraptus serra (2).
Tetragraptus bryonoides (1).
Tetragraptus similis (2).
Phyllograptus cf. *typus* (5).

Horizon, Castlemainian, base of series.

NEWER SILURIAN FOSSILS OF EASTERN VICTORIA.

PAR III.[1]

By Frederick Chapman, A.L.S., F.R.M.S., Palæontologist to the National Museum, Melbourne.

(Plates XLVI.-LXI.)

FROM GRIFFITH'S QUARRY, LOYOLA, NEAR MANSFIELD.

(Nos. 2480-95, 2497, 2505, 2507, 2508, 2512, 2515, 2517-19.)

Collected by W. H. Ferguson.

Specimen No.	Fossils, with remarks.
2480 ...	Mould of a small specimen of *Leptæna rhomboidalis* Wilckens sp., in ochreous mudstone.
2481 ...	A doubtful brachiopod, probably referable to the *Strophomenidae*.
2482 ...	A grey limestone with *Receptaculites fergusoni* Chapm. (see Notes). Also a portion of a cephalopod, partly in section, probably referable to *Orthoceras*. Numerous crinoid joints scattered throughout the matrix of the limestone.
2483 ...	A cephalopod (cyrtoceracone), probably allied to *Protophragmoceras* (see Notes).
2484 ...	Limestone specimen partially decomposed and replaced by ferric oxide; consisting of a massive coral, the intramural spaces of the calices of which are mineralised and partially replaced by radiating crystals. Probably referable to *Columnaria* (*Loyolophyllia*) *cresswelli* subgen. et sp. nov.
2485 ...	Limestone largely composed of crinoid remains, indet.
2486 ...	A large mass of limestone chiefly composed of corals and crinoids, indet. A fine corallum of *Fistulipora victoriæ*, sp. nov. on the weathered surface (see Notes).
2487 ...	Corallum of *Phillipsastræa speciosa*, sp. nov. (see Notes).
2488 ...	Limestone with corals. In the calcareous matrix of the microscope section (Slide 1372) may be seen remains of crinoids, ostracoda and tests of trilobites. The rock contains a large mass of the coral *Columnaria* (*L.*) *cresswelli*, measuring more than 6cm. in width (see Notes).
2489 ...	A massive coral limestone, composed almost entirely of the corallum of *Phillipsastræa walli* Eth. fil. (see Notes.)
2490 ...	A slab of crinoidal limestone with *Columnaria* (*L.*) *cresswelli*, and other corals (see Notes).
2491 ...	*Phillipsastræa walli* Eth. fil. (see Notes).
2492 ...	Crinoidal limestone.

[1] For Part I. see Records, vol. II., pt. 1, 1907, pp. 67–80; for Pt. II., *ibid.* vol. III., pt. 2, pp. 224–233.

Specimen No.	Fossils, with remarks.
2493 ...	Mudstone with an impression of *Orthis* (*Dalmanella*) sp.; an internal cast of a bivalve, indet.; a mould of the articular facet of a crinoid columnar; several examples of *Beyrichia maccoyiana* Jones, var. *australiæ* Chapm.; and casts of *Phacops sweeti* Eth. fil. & Mitch.
2494 ...	Crinoidal limestone with corals, including *Columnaria* (*L.*) *cresswelli*. Three young examples on this slab, showing the form of the corallum (see Notes).
2495 ...	Mudstone with obscure fossils, and portion of the pygidium of a large specimen of (?) *Bronteus* cf. *enormis* Eth. fil. (see Notes).
2497 ...	An impure cherty mudstone with pyrites crystals. No fossils.
2505 ...	A crinoidal limestone. A section of a gasteropod of indeterminate character seen on the surface.
2505, 2507, 2515	Mudstone with impressions of crinoid stems, indet.
2508 ...	Mudstone with impressions of crinoid stems and a cast of *Orthis* (*Schizophoria*) sp.
2512 ...	Mudstone with impressions of brachiopods, (?) *Strophеodonta*.
2518 ...	Mudstone; no determinable fossils.
2519 ...	Mudstone showing the pygidium of a trilobite (?) *Phacops* and an external mould of a rhynchonellid, indet.

Age.—Silurian (Yeringian). Limestones and mudstones.

FROM HOWE'S CREEK QUARRY, LOYOLA, NEAR MANSFIELD.
(Nos. 2496, 2498-2504, 2506, 2509-11, 2513, 2514.)
Collected by W. H. Ferguson.

Specimen No.	Fossils, with remarks.
2496 ...	Mudstone, with a fragment of (?) *Phacops* sp.
2498 ...	Mudstone, with casts of *Styliola fissurella* J. Hall, var. *multistriata* Chapm.; also internal cast of (?)*Orthoceras*.
2499, 2501, 2502, 2504, and 2506	Mudstone, with casts of (?) *Orthoceras* sp.
2500 ...	Mudstone, with cast of a fenestellid, indet.
2503 ...	Mudstone, no fossils.
2509 ...	Impression of valve of imbricated var. of *Atrypa reticularis*, sp., in mudstone.
2510 ...	*Leptæna rhomboidalis*, Wilckens sp.; and a cast of a (?) monticuliporoid in mudstone.
2511 ...	Cast of a gasteropod, indet., in shale.
2513 ...	Cast of a brachiopod, including *Orthis* (*Dalmanella*) sp.
2514 ...	Cast of (?) *Leptæna rhomboidalis* in mudstone.

Age.—Silurian (Yeringian and younger). Near the horizon of the slates and mudstones of the Matlock District.

Fossiliferous Limestones from Middle Crossing, Deep Creek, Walhalla.

(Nos. 562, 564, 568, 571, 573, 575, 576, 578, 584, 585, 587, 588, 589, 592.)

Also No. 746.—Cooper's Creek, behind Chinamen's Garden, and No. 749.—Behind Cooper's Creek Copper Mine.

Collected by W. Baragwanath.

Note.—The following is an extended and detailed report on the series of fossils provisionally determined in a previous Report sent in, 14th May, 1908[1]. The specimens are chiefly corals, and consequently had to be sliced and microscopically determined. The palæontological details are given in the Notes, p. 304.

Specimen No.	Fossils, with remarks.
562 ...	Dark blue limestone with numerous corals. *Clathrodictyon* cf. *regulare* Rosen sp.; a massive encrusting form (see Notes). Also *Pachypora alterivalis*, sp. nov. (see Notes). The calcareous mud contains, besides corals, joints of crinoids, polyzoa, ostracoda and trilobite fragments.
564 ...	A nearly perfect corallum of *Favosites nitida*, sp. nov. in a good state of preservation (see Notes). The coral is covered on the upper surface with a layer of limestone matrix containing crinoid joints and other fossil remains.
568 ...	Coral limestone, with *Favosites forbesi* Edw. and Haime (see Plate lvi., fig. 27).
571 ...	Limestone with numerous corals and polyzoa, including some small (?) zaphrentids, indet., and several examples of a polyzoan allied to *Cheilotrypa*. Also a branching *Favosites*, sp. indet. (see Plate lvi., fig. 26).
573 ...	*Favosites forbesi* E. and H. A well preserved corallum of a depressed form (see Notes).
575 ...	*Alveolites* sp. aff. *suborbicularis* Lamarck (see Notes). Also (?) *Tryplasma* cf. *murrayi* Eth. fil. (on weathered surface).
576, 578, 584, 588, and 749	*Favosites nitida*, sp. nov. (see Notes).
585 ...	Fragmentary corals and crinoid remains, indet.
587 ...	*Favosites gothlandica* Lam. A large corallum, with good structure.
589 ...	*Favosites gothlandica* Lamarck (see Plate liii., fig. 20).
592 ...	A stromatoporoid (*Clathrodictyon* sp.). Also *Favosites nitida*, sp. nov.; the corallites in this specimen are remarkably rectilinear, the species being identified partly by the large mural pores (see Notes).
746 ...	A large block of dark blue limestone, showing on a polished surface the following fossils:—A compound cyathophylloid, indet.; *Favosites forbesi* Edw. & Haime; *Heliolites interstincta* L. sp., var. *gippslandica*, var. nov.; *Stromatoporoids*, indet.; and crinoid remains. Also *Cyathophyllum approximans*, sp. nov. on weathered surface of specimen.
749 ...	*Favosites nitida*, sp. nov.; a compact fasciculate form, showing the large mural pores.

[1] See Records Geol. Surv. Vict., vol. III., pt. 2, 1911., p. 228.

Notes on the Fossils.

SPONGIDA.

Genus **Receptaculites** Defrance.

Receptaculites fergusoni Chapman. Plate XLVI., figs. 1–4.

Receptaculites fergusoni Chapman, 1905, Proc. Roy. Soc. Vict., vol. XVIII. (N.S.), pt. I., p. 6, pl. II., figs. 1 and 3; pl. IV., fig. 1.

The type specimen of the above species is a mud cast of the outer wall of the sponge. It is, therefore, extremely interesting to find this second specimen having the structure of the wall more or less well preserved in limestone; although the latter is probably not the original substance of its organic framework.

In my previous description the dimensions of the rhombic plates (of the ectorhin) are given as 1.5mm. in longest diameter, and it is there stated that "they do not show much variation in size."[1] That general uniformity in the size of the plates is evidently due to the type specimen showing only the basal part of the cup. The plates of the specimen from Loyola are from the inner or upper layer of the sponge (endorhin), and are larger than the plates formerly described from the ectorhin of the apex, measuring as much as 3mm. in diameter. As may be seen, however, the plates of both layers would naturally increase in size as they receded from the base of the cup.

The shape of the cup in *R. fergusoni* is broad and low (as well shown in the Loyola specimen), and with a moderately deep funnel (shown in the mud cast). This species differs in a striking manner from *R. salteri*, of the Devonian and Carboniferous of Australia[2]; for the boundaries of the rhombic plates, as in *R. neptuni* Defr., are wavy or crenulate. The sliced surface of the Loyola specimen shows very clearly the slender vertical pillars of the cup, the elongate rhombic form of the plates of the endorhin, and the long connecting rays of the four-rayed spicules of the summit plates. From the present evidence, this Victorian Silurian species of *Receptaculites* had an approximate diameter of nearly 6cm.

ANTHOZOA.

Fam. Cyathophyllidae.

Genus **Cyathophyllum** Goldfuss.

Cyathophyllum approximans, sp. nov. Pl. XLVII., figs. 5, 6.

Description.—Corallum compound; consisting of polygonal, usually hexagonal corallites, averaging 10mm. in diameter. Primary septa about 20, moderately thick in median area, becoming thin towards the central axis where they are joined in pairs, being slightly twisted to form a false columella. Secondary septa also thicker in median area, about 20, alternating with the primary and terminating at about two-thirds the distance from the periphery to the axis. Dissepiments tending to become vesiculose. Epitheca thin. Tendency to separate into corallites very slight. Weathered surface of corallum shows corallites with columellar axis and outer portion of septa in strong relief.

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1 *Loc. cit.* p. 7.

2 Salter, Canad. Org. Remains, Dec. 1, 1859, p. 47, pl. X., figs. 8–10. Etheridge and Dun, 1898, Rec. Geo. Surv., N.S. Wales, vol. VI., pt. I., p. 62, pl. VIII.–X. Chapman, Proc. Roy. Soc., Vict. vol. XVIII. (N.S.), pt. I., 1905, p. 7, pl. II., figs. 2, 4–7; pl. III.; pl. IV., figs. 2–7.

Affinities.—This species is so close to the Middle Devonian form *C. mitchelli* Eth. fil.[1] that it was at first sight identified with it. A microscopical examination of the Gippsland Silurian species showed it, however, to differ in the following characters :—

Cyathophyllum approximans.

Septa varying from 35 to 40, never more. Thickened in median area.
Dissepiments thin and vesiculose.
Epitheca thin.
Corallite wall straight.

Cyathophyllum mitchelli.

Septa varying from 40 to 44. Uniform in thickness.
Dissepiments thick and regularly curved.
Epitheca thick.
Corallite wall often flexuose.

Observations.—This elegant species is not uncommon in the Silurian limestone of Cooper's Creek, Gippsland. It occurs in the present series in No. 746, in which a weathered example measures 8.5cm. by 7cm. Some typical specimens of *C. approximans* are also found in a collection of fossils presented to the National Museum by the Rev. A. W. Cresswell, M.A., in 1887, from the same locality. A transverse section of one of these is here figured.

In working out the affinities of this species I have been assisted by the kindness of Mr. A. J. Shearsby, F.R.M.S., of Yass, who has supplied me with specimens of *C. mitchelli* from New South Wales for comparison, and who confirms my opinion as to the distinctness of the two forms.

Genus **Phillipsastræa** Edwards & Haime.

Phillipsastræa walli Etheridge fil. Plate XLVIII., figs. 7–9.

Phillipsastræa walli R. Etheridge, jnr., 1892, Rec. Geol. Surv., N.S. Wales, vol. II., pt. 4, p. 169, pl. XI., fig. 7.

As Mr. Etheridge has pointed out, this coral is related to certain species with delicate septa like *P. bowerbanki* Ed. & H. sp. It further agrees with that species in the approximate number of septa. By its occurrence with some frequency in the Silurian of Hatton's Corner, near Yass, this coral establishes its position as an undoubted member of the Silurian fauna of S.E. Australia, although a Devonian genus elsewhere; and this is further supported by its present occurrence at Loyola, near Mansfield, in a fauna typically Wenlockian.

The specimens from the blue limestone of Loyola are excellently preserved, and it appears to be a not infrequent fossil in that series. The mural circle of the calices is not so well developed in the Victorian examples, but the boundary can be distinguished by the change of form in the dissepiments from convex to concave as they pass beyond what might be termed the "primitive cup." The Victorian specimens agree with Mr. Etheridge's in having 20 septa, and so far as I have seen, the calices in ours are from 4-6mm. apart.

P. walli occurs in quite large masses in the Loyola limestone, one fragment of a larger piece measuring as much as 15cm. by 7cm., and nearly 3cm. in thickness.

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1. Rec. Geol. Surv. N.S.Wales, vol. II., pt. 4, 1892, p. 172, pl. XI., figs. 9, 10; pl. XII., fig. 4

PHILLIPSASTRÆA SPECIOSA, sp. nov. Plate XLIX., figs. 10, 11 ; pl. L., figs. 12–14.

Description.—Corallum massive, with flexuous surface, of moderately lorge extent. Greatest thickness of type specimen, 24mm. Calices 4 to 6mm. wide. Inner area well marked in weathered specimen by the thickened rim of the "primitive cup," the latter about 2mm. in diameter. Septa alternate, numbering about 26 ; straight or slightly curved from near centre of calice to the margin, where they become strongly geniculate ; thick in median zone of calice, tapering to a thin edge within the calice, and again thinning towards the geniculate contact with adjacent series of septa ; sides of septa carinated or toothed as in *P. verneuili*, and more so than *P. currani*. Space between calices about 4-7mm. In horizontal section, the septal ridges are seen to be sparsely but distinctly perforate, as in *P. verneuili*, as noticed by L. M. Lambe[1], who remarks on the analogous structure seen in some species of the genus *Arachnophyllum*.

Affinities.—This species is in some respects related to Mr. Etheridge's described form, *P. currani*, for a small variety of which it might at first sight be taken. That coral, however, has septa of equal length, in number 28-32, and the individual corallites are from 8-10mm. across. Another point of difference is that the septal extremities in *P. speciosa* dip well into the "primitive cup," often extending to the centre, whilst in *P. currani* they are limited to the mural circle. The nearest related form to the present one is *P. verneuili* Edw. & Haime[2], which it resembles in many particulars, as in the carinate septa and the high mural wall of the "primitive cup." The specific differences are—the greater number of septa in *P. verneuili*, from 30-46 ; its larger corallites, 10-16mm. across ; and larger "primitive cup," 3-5mm. in diameter. *P. verneuili* was recorded from Cope's Gully, N.S. Wales, by De Koninck[3], from a stratum regarded by R. Etheridge, jnr.[4], as doubtfully Devonian. for the latter author remarks, "It, however, yet remains to be satisfactorily proved that the localities ascribed to the Devonian are actually within the boundaries of rocks of that age, a fact of which I am at present not convinced."

FAM. COLUMNARIIDAE.

GENUS **Columnaria** Goldfuss, 1826 (= Favistella, J. Hall, 1847) ; **Loyolophyllum,** sub-genus nov.

COLUMNARIA (LOYOLOPHYLLUM) CRESSWELLI, sp. nov. Plate LI., figs. 15, 16 ; pl. LII., figs. 17, 18.

Description.—Corallum radiately fasciculate, or mushroom-shaped ; measuring, in examples found, from 13mm. to 8cm., or more across. In young stage attached by a pedicel, as in other compound corals like *Cyathophyllum* and *Favosites*. Corallites contiguous, hexagonal, but occasionally pentagonal, sides not always equal, with a thick spurious thecal wall. Septa well developed, alternately long and short, numbering altogether about 20 ; fused to base and thickened, otherwise slender and, in the case of the primaries, extending to the centre, or nearly so ; shorter septa terminating acutely, the longer bluntly or even with club-shaped ends. Four or five of the primary septa predominant, as in the genus *Stauria*. Tabulae deeply concave, turned towards the calice, rather widely spaced, occupying the central area ; the lateral area being filled with coarse vesicular tissue.

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1. Contrib. Canad. Palæont., vol. IV., pt. II., 1901, p. 166.
2. Polyp. Foss. des Terr. Paleoz., 1851, p. 447, pl. X., fig. 5 ; Lambe, *op. supra cit.*, p. 166, pl. XIV., fig. 4.
3. Foss. Pal. Nouv.-Galles du Sud, 1876, pt. 2., p. 69.
4. Rec. Geol. Surv., N.S.Wales, vol. II., pt. 4., 1892, p. 166.

Measurements.—Diameter of corallites, 1 to 1.13mm. in diameter in the type specimen, ranging to 2mm. in others. Average space between tabulae, 1mm.

Characters of Loyolophyllum, subgenus nov.—Structural features as in *Columnaria*, but having deeply concave tabulae and a lateral or outer vesicular zone.

Observations.—The type specimen of the above new species is selected from the Rev. A. W. Cresswell's collection, presented many years ago to the National Museum (October, 1887). Several remarkably fine examples, as regards external form, of the above very interesting coral, occur in the present series. The internal structures of the specimens are, however, not so well preserved as could be wished. This indifferent condition of structure resembles to a remarkable degree the general characters seen in *Cyathophyllum elegantulum* Dun[1], the agreement in the number of septa, the curved tabulae, and the zone of vesicular tissue making the resemblance very striking. From an examination of the original types of *C. elegantulum* very kindly lent to me by Mr. W. S. Dun, F.G.S., it was possible to distinguish the two forms on the following characters:—The greater thickness of the corallite walls in our *Columnaria*; the continuance of the septa to the centre of the calice; the more widely spaced tabulae; the smaller corallites; and the radiate habit of the corallum.

The specimens of *Columnaria* presented by Mr. Cresswell I had already referred to that genus in 1902, but feeling some doubt as to certain differential characters here regarded as subgeneric, they were put aside until the present time. In these specimens, the walls and septa are preserved as a finely granular, grey material; whilst the contiguous corallites are separated by a conspicuous dark line. The intermediate, calicular pouches are traversed in the outer zone by endothecal or vesicular tissue in the form of curved dissepiments, the latter rudely concentric; the whole cavity being infilled with coarsely crystalline calcite. The primary septa, which are of irregular lengths, in some cases extend quite to the centre; whilst often there are four or five nearly meeting at the centre; thus recalling the septal arrangement in *Stauria*. To this point, we will revert a little farther on. The secondary septa, starting from the centre of each "petal," are much shorter, usually only one-third the length of the primaries. The thecal margins of the visceral cavities are rounded and scalloped like the petals of a rose, giving a petaloid appearance to the corallites as seen in *Columnaria*. Vertical sections of the coral show the inner thecal wall striated longitudinally, as in *Columnaria*, but unlike the genus in its strict interpretation, the tabulæ, instead of being horizontal, are more often curved and concave, or even funnel-shaped; whilst the highly developed vesicular structure further removes it from typical forms of that genus.

The following details of the external form of the coral may be of interest. On slab No. 2494, there are three examples of this coral, all of which are in a young stage. The largest, measuring 36mm. across, is figured here. The remaining two coralla measure about 13mm. across, one of which shows a very perfect root-stalk. The coral is of a depressed mushroom shape, with a distinct foot-stalk. During growth, the corallites show a tendency to curve outwards, so that a section parallel to the central axis is fan-shaped. The increase in the number of corallites and the consequent growth of the corallum, is maintained by the insertion of young corallites in the interspaces formed by the recurvation of the existent corallites, according to the law of intermural gemmation. In older specimens, the corallites show only a slight tendency to divergence, being practically of the same diameter nearly throughout.

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1. *Cyathophyllum elegantulum* W. S. Dun, Proc. Roy. Soc., Vict., vol. X. (N.S.), pt. II., 1898, p. 85, pl. III. figs. 5, 6. See also R. Etheridge, jun., Prog. Rep. Geol. Surv., Vict., No. XI., 1899, p. 31, pl. B., figs. 2–4.

In speaking of the affinities of *Columnaria*, Professor Nicholson says[1], "There is sometimes a curious irregularity of the septa, one or more being predominantly developed, and there are also two distinct sets of these structures, a long and a short series, alternating regularly with one another." In the present species four or five are predominant, and this leads us to quote further from Nicholson (p. 193). "In fact, it might be at once, and without any violence, placed in the *Stauridæ*, close to *Stauria*, except that there is no predominant development of four of the septa." There is, however, in the Loyola examples the obvious development of certain of the primary septa, and that would seem to imply a like relationship with the *Stauridæ*, although not agreeing precisely in the numerical arrangement of the septa.

In the ill-preserved examples in the present collection the septa appear, under the microscope by transmitted light, to be partially dissolved out, especially towards the centre of the calice; and therefore the normal, twisted, club-ended terminals of the primary septa cannot be easily discerned. But a curious restoration of these apparently badly preserved corals may be made by taking a covered microscope section of the coral and holding it obliquely at an angle of total reflection before a strong light, when the thick wall of the corallite, and the alternate septa, with the festooned *Favistella*-like thecal margin, may be easily seen.

There is one other Australian species of *Columnaria* already described, by Mr. R. Etheridge, jun., namely, *C. pauciseptata*, from the Silurian rocks of Molong, New South Wales[2]. The corallites of this form are of the same diameter as our type, but only half the size of the largest Loyola specimen, that is, having a diameter of one millimetre; which dimension Mr. Etheridge says is constant. Moreover, it has 16 septa, against 20 in the present form, whilst the corallites in the Molong coral are more consistently irregularly polygonal.

Columnaria (*Loyolophyllum*) *cresswelli* is apparently confined to the Loyola fauna, for, although the Newer Silurian limestone of the Thomson River area and of Lilydale (Cave Hill) have been more or less worked over for their corals, the species has not yet been met with at those localities.

Fam. Favositidæ.

Genus **Favosites** Lamarck, 1816.

Favosites forbesi Edwards and Haime. Plate LIII., fig. 19; pl. LVI., fig. 27.

Favosites gothlandica Lonsdale (non Lamarck), 1839, in Murchison's Silurian System, p. 682, pl. XV. bis, figs. 3, 4.

F. forbesi Edwards and Haime, 1855, Mon. Brit. Foss. Corals (Pal. Soc.), p. 258, pl. LX., figs. 2, 2*a–g*. Nicholson, 1879, Tabulate Corals, p. 56, pl. I., fig. 7; pl. II., figs. 1–3; pl. III., figs. 1, 2.

Numerous coralla, referable to the above species, occur on the surface of a block of limestone (No. 746), from Cooper's Creek. The corals are generally of small size, measuring from 2-4 cm. across. They are subglobular or depressed pyriform, and are distinguished by the irregular size of the corallites. The tabulæ and mural pores are like those of *F. gothlandica*, to which it bears a close relationship. Another specimen, here figured, occurs in a microscope section from No. 573, Deep Creek, which well illustrates the quick change of growth from layer to layer, at varying angles. Fig. 27 on plate LVI. represents a section of the same species, also from Deep Creek, taken close to the stalked base of the corallum.

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1. Tabulate Corals, 1879, p. 193.
2. Rec. Austr. Mus., vol. III., No. 2, 1897, p. 30, pl. VIII.

FAVOSITES NITIDA, sp. nov. Plate LIV., figs. 21–23; pl. LV., figs, 24, 25.

cf. Favosites, sp. indet., Etheridge, jun., 1899, Prog. Rep. Geol. Surv. Vict. No. XI., p. 33, pl. B., figs. 7–9.

Description.—Corallum of moderate size; largest specimens measuring about 7 or 8cm. Corallites slender, radiating, with moderately thick walls; normally hexagonal, but sometimes pentagonal or subrectangular, with two of the sides reduced by crowding of contiguous corallites. Diameter of corallites, 0.5 to 0.75mm. In transverse section showing traces of spiny septa; maximum number 12, two on each corallite face when fully developed. In vertical section the mural pores are seen to be placed in a single row, sometimes sinuous, down the centre of each corallite face, and are of large size (0.17mm. in diameter); smaller dark dots are visible on the corallite walls, and are the bases of the septal spines. Tabulæ numerous, 3 or 4 in the space of 1mm., somewhat irregular, horizontal, concave or oblique.

Observations.—The above species agrees very closely with Mr. Etheridge's preliminary description of a *Favosites* from the Silurian of Wombat Creek, Gippsland, and is in all probability identical with that form. Transverse sections of *F. grandipora* Eth. fil.[1], approach this form in the size of the corallites and their septal spines; but the two species are readily separable by the thick walls of *F. grandipora*, and in vertical section by the thin tabulæ and the slender septal spines, as well as the thicker corallite walls of the same species.

Some of the specimens here referred to the above species show a striking resemblance to *F. basaltica*, var. *salebrosa* Eth. fil.[2], of the Woolomool limestone of Tamworth, New South Wales, especially in the small corallites with their widely-spaced tabulæ. However, that variety shows no recognizable septa.

Occurrence.—Deep Creek; also Cooper's Creek (behind copper mine).

GENUS **Pachypora** Lindström, 1873.

PACHYPORA ALTERIVALIS, sp. nov. Plate LVII., figs. 28, 29.

Description.—Corallum small, ramose, with cylindrical branches. Length about 2cm., or slightly longer (specimen imperfect); width of branch, 4mm. Corallites radiately divergent, mouths of calices roundly polygonal to subovate, 0.34 to 0.45mm. in diameter. Tabulæ very scarce, slightly concave; mural pores few and large, irregularly placed. Walls of corallites thick.

Affinities.—This species closely approaches *Pachypora cristata* Ed. and H. sp.[3], a fossil from the Wenlock Series of England. This is especially so in regard to the small size of the corallum with its rounded branches, the subcircular to polygonal calices and the concavely curved tabulæ.

The species described from the Middle Devonian (Burdekin Series) of Queensland by Messrs. Nicholson and Etheridge, jnr.[4], under the name of *P. meridionalis* is different from ours in its more circular corallites and apparently horizontal tabulæ.

Occurrence.—Deep Creek, Thomson River, Gippsland.

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1. Rec. Austr. Mus., vol. I., No. 3, 1890, p. 61, pl. VIII., figs. 6–9.
2. Rec. Geol. Survey., N.S. Wales, vol. VI., pt. 3, 1899, p. 166, pl. XXI., figs. 3–5; pl. XXVII., figs. 1, 2.
3. Polyp. Foss. des Terr. Pal., 1851, p. 342: Brit. Foss. Corals 1854, p. 260, pl. LXI., figs. 3 and 4; Nicholson, Tabulate Corals, 1879, p. 87, pl. IV., figs. 4–4*b*; pl. V., figs. 1, 1*b*.
4. Ann. and Mag. Nat. Hist., ser. V., vol. IV., 1879, p. 280; Etheridge and Jack, Geol. and Pal. of Queensland, 1892, p. 51, pl. II., figs. 10–15.

Genus **Alveolites** Lamarck, 1801.

Alveolites sp. aff. suborbicularis Lamarck. Plate LVIII., fig. 30.

This specimen is a fragment measuring 26 by 8mm. It is attached to a layer in the coral mud matrix by its flat side. The only indication of internal structure within the cells is a thick septum in one or two, recalling a similar feature in *Alveolites suborbicularis* Lam.[1] of the Middle Devonian of the Eifel. True septa, as in *Alveolites labechei* Edw. and Haime[2] of the Wenlock, seem to be absent in this example; and, altogether, the affinities seem to be closer to the Devonian species above named. The corallites in the Deep Creek specimen increase rapidly in size from the base of attachment to the distal surface, and measure from 1 to 3mm. in transverse diameter.

Fam. Fistuliporidae.

Genus **Fistulipora** McCoy.

Fistulipora victoriae, sp. nov. Plate LVIII., fig. 31; pl. LIX., figs. 32–34.

Description.—Corallum somewhat massive, ramose, subcylindrical or expanded; length in present type, 6.5cm.; formed of successive layers of corallites, 3 to 6mm. in thickness; corallites of two kinds, thin walled. The autopores are subcylindrical, and average 2mm. in diameter; in vertical section they are seen to be divided by more than usually numerous tabulae, which are curved and concave towards the outer surface of corallum, and generally 0.3mm. apart. The mesopores are as large, or larger, than the autopores, polygonal, and arranged radiately around the autopores; in vertical section they are in single, or in two or more series, according to their relation to the autopores, but generally double, and numerously divided into low, subangular cells, by curved (convex) tabulæ or partitions; average diameter about 0.25mm. Occasional maculae of twice the diameter of the autopores.

Affinities.—Perhaps the species nearest to ours is *F. lockportensis* Bassler, from the Niagara Limestone (Wenlockian) of Lockport, N.Y. State.[3] In that species, the autopores measure 0.5mm. in diameter, imparting to the corallum a coarser structure; whilst the tabulæ are very rare, or altogether wanting.

Observations.—This genus has been before noted from the same series of limestones (Wenlockian) in Victoria, from the Thomson River, Gippsland[4], but the specimen was not sufficiently well preserved for specific identification. Enough can be seen, however, to show that it differs from the present form, and it was probably of a more frondescent type of growth.

Occurrence.—Griffith's Quarry, Loyola.

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1. Hist. des Anim. sans Vert., 1816. vol. II., p. 186: Milne Edwards and Haime, Brit. Foss. Corals 1853, p. 219, pl. XLIX., figs. 1, 1*a*; Nicholson, Tabulate Corals, 1879, p. 126, pl. VI., figs. 2, 2*b*, and woodcut, fig. 20.

2. See Nicholson, *op. cit.*, p. 128, pl. VI., figs. 3, 3*a*.

3. "The Bryozoan Fauna of the Rochester Shale." Bull. U.S. Geol. Surv., No. 292. 1906. p. 23, pl. VII., figs. 1–3.

4. "Newer Silurian Fossils of Eastern Victoria, pt. I." Rec. Geol. Surv., Vict., vol. II., pt. 1. 1907, p. 76, pl. II., fig. 3.

Fam. Helioporidæ.

Genus **Heliolites** Dana, 1846.

Heliolites interstincta Linné sp., var. Gippslandica, var. nov. Plate LX., Figs. 35, 36.

Description.—The specimen to which the above varietal name is appended measures 9cm. in length, and its greatest thickness is 3.2cm. In form it is flat and undulating on the surface of attachment. This variety differs from the almost universally distributed type species [1] in having the autopores (calices) practically unseptate, two or rarely three si phonopores (coenenchymal tubules) between the autopores, and in having the tabulæ of the latter often deeply concave and never quite horizontal. Autopores nearly always circular, with hardly any trace of septa, although slightly angulated at twelve equidistant parts in the periphery, where they are conjoined to the walls of the siphonopores. The autopores have a diameter of 1.25 to 1.75mm. Their tabulæ are deeply concave, and vary from 4 to 5 in the space of one millimetre. The siphonopores are roundly polygonal or flattened by crowding, in transverse section; in vertical section they are divided by tabulæ, and appear as low rectangles, polygons or triangles. The tabulæ of the siphonopores number from 4 to 7 in the space of one millimetre.

Observations.—The species itself occurs at Cave Hill, Lilydale, and at Waratah Bay, associated with a characteristic Wenlock fauna. It is found at the former place usually in rounded or nodular masses, and more rarely with encrusting or explanate coralla.

The present variety approaches McCoy's *H. megastoma* [2] in some respects, as in the rudimentary septation and unusually small proportion of coenenchymal tissue, but in that species the autopores are typically larger, proportionately; and since there appears to be some doubt as to whether the Ordovician and the Silurian specimens ascribed to that species are identical [3], the question of its affinity with ours may here be waived, remarking in passing that the Wenlock examples, with their rudimentary septa, are closely related to *H. interstincta.*

Occurrence.—Cooper's Creek, Thomson River.

Hydrozoa Stromatoporoidea.

Fam. Actinostromidæ.

Genus **Clathrodictyon** Nicholson and Murie, 1878.

Clathrodictyon cf. regulare Rosen sp.[4]. Plate LXI., Fig. 37.

The present specimen is an encrusting form attached to a calcareous mud pellet containing fragments of corals, crinoid stem-joints, polyzoa, ostracoda, and fragments of tribolites. This portion of a *Clathrodictyon*

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1. *Madrepora interstincta* Linné, 1767, Syst. Nat., 12th Ed., p. 1276. *Heliolites interstincta* L. sp.. Edwards and Haime, 1851, Polyp. Foss. des Terr. Palaeoz, p. 214. *Id.*, Brit. Foss. Corals, 1855, p. 249, pl. LVII., figs. 5, 5*a–d*. Röminger, Geol. Surv., Mich., Fossil Corals, p. 11, pl. I., fig. 1. Nicholson, Sil. Foss. Girvan, 1880, pp. 57 and 254, pl. XVI., figs. 1–4. Lambe, Contr. Canad. Pal., vol. IV., pt. I., p. 79, pl. II., figs. 6. 6*a*.

2. *Palaeopora megastoma* McCoy, Pal. Foss., 1852, p. 16, pl. I., fig. 4. *Heliolites megastoma* McCoy sp., Edwards and Haime, Brit. Foss. Corals, 1855, p. 251, pl. LVIII., fig. 2.

3. Nicholson, Sil. Foss. Girvan, 1880, p. 248.

4. *Stromatopora regularis* Rosen, 'Ueber die Natur der Stromatoporen," 1867, p. 74, pl. IX., figs. 1–4. *Clathrodictyon regulare* Rosen sp., Nicholson and Murie, Ann. and Mag. Nat. Hist., ser. 5, vol. XIX., 1887, p. 10, pl. II., figs 5, 6; Nicholson, Brit. Stromatoporoids (Pal. Soc.), 1889, pt. II., p. 155, pl. XVIII., figs. 8–11*a*.

measures, roughly, 2cm. square. The laminæ of the coenosteum, as seen in a vertical section, are well marked, and number from 4 to 6 in the space of one millimetre. In our specimen instead of an intermediate dark line in the laminæ there is a lighter area, probably due to recrystallization of the substance of the platform.

There can be very little doubt regarding the specific identity of this fossil, but in the absence of other sections and specimens it is here treated provisionally under the above name.

The distribution of this species has hitherto been confined to Northern Europe. It has occurred at Dudley in England, at Wisby, Gotland, and in Esthonia in the Baltic Provinces. All of these occurrences are in the Wenlock Series (Gotlandian), to which our own Deep Creek limestone-fauna is most nearly allied.

CEPHALOPODA.

Genus **Protophragmoceras** Hyatt.

(?) Protophragmoceras sp. Plate LXI., Figs. 38, 39.

Specimen No. 2483 is a cephalopod shell, in form gently and arcuately curved, broad at the anterior, with evidence of a body-chamber overhanging the primary half of the shell on the concave side. The margins of the body chamber are large, open and somewhat reflexed. In section the wall of the septum of the body chamber is thick. The apex of the shell is only slightly curved, and bluntly and roundly terminated. The septal walls are nearly all dissolved away, and the entire cavity below the septum of the body chamber is infilled with fine calcareous mud containing small crinoid arm-ossicles, trilobite fragments, carapaces of ostracoda, and polyzoal remains. The body chamber is also filled with a similar matrix. The outer shell-wall is in fair condition. It is black, glossy, and in a microscope section shows the characteristic structure of a cephalopod shell. In general form this fossil is suggestive of a shell-like (?) *Protophragmoceras maccoyi* Foord sp.[1]

TRILOBITA.

Genus **Bronteus** Goldfuss.

(?) cf. Bronteus enormis Etheridge fil.

(?) *Bronteus enormis* Etheridge jnr., 1894, Proc. Roy. Soc., Vict., Vol. VI. (N.S.), p. 189, Pl. XI.

Specimen No. 2495 contains a cast in reddish brown mudstone, of a fragment of a large trilobite pygidium, measuring 61 by 58mm. It is probably referable to the same form as the Delatite specimen found by Mr. Sweet, and described by Mr. Etheridge in the paper referred to above. The densely pitted surface described by Etheridge as a character

1. *Phragmoceras arcuatum* (pars) Sowerby, Murchison's Sil. Syst., pt. II., 1839. p. 621. pl. XI., fig. 1 (non pl. X., fig. 1). *Cyrtoceras* (*Meloceras*) *m'coyi* Foord, Cat. Foss. Ceph. Brit. Mus., pt. I., 1888, p. 303.

of his fossil is distinctly seen in our specimen. Another example of a large pygidium of similar form, from near Lilydale, is in the collection of the National Museum, presented by the Rev. A. W. Cresswell.

Locality List of Fossils Identified and Described in the Present Report.

Name.	Loyola (Griffith's Quarry.)	Loyola (Howe's Creek Quarry).	Deep Creek.	Cooper's Creek.
Receptaudtes fergusoni Chapm.	2482	..	..	..
Zaphrenismaindet.	..	..	571	..
(?) *Tryplalisc* cf. *murrayi* Eth. fil.	..	..	575	..
Cyathophyllum approximans, sp. nov.	..	..	..	746
Phillipsastræa walli Eth. fil. ..	2489, 2491	..	..	..
Phillipsastræa speciosa, sp. nov. ..	2487	..	..	..
Columnaria (*Loyolophyllum*) *cresswelli*, sub. gen. eot. sp. nv. ..	(?) 2484, 2488, 2490	..	..	..
Favosites gothlandica Gold.f sp. ..	..	..	587, 589	..
Favosites forbesi Ed. and H. ..	..	..	568, 573	746
Favosites nitida, sp. nov. ..	..	..	564, 576, 578, 584, 588, 592	749
Favosites, sp. indet. (branching form) .	..	..	571	..
Pachypora alterivalis, sp. nov ..	..	..	562	..
Alveolites sp., aff. *suborbicuaris* Lam.	..	..	575	..
Fistulipora victoriae, sp. nov. ..	2486	..	..	..
(?) Monticuliporoid, indet. ..	..	2510	..	..
Heliolites interstincta L., var. *gippslandica*, var. nov.	..	..	746	..
Clathrodictyon cf. *regulare* Rosen. sp.	..	..	562	..
Stromatoporoid, indet... ..	..	..	..	746
Crinoid remains, indet. ..	2482, 2485, 2488, 2490, 2492, 2494, 2505, 2507, 2515	..	562, 564	746
Fenestellid, indet.	..	2500	..	..
Polyzoan, allied to *Cheilotrypa* ..	..	..	571	..
Polyzoan, indet.	..	..	562, 571	..
(?) *Stropheodonta*	2512	..	..	..
Leptæna rhomboidalis Wilck. sp. ..	2480	2510,(?)2514	..	..
(?) Strophomenid, indet. ..	2481	..	..	..
Orthis (*Dalmanella*) sp. ..	2493	2513	..	..
Orthis (*Schizophoria*) sp. ..	2508	..	..	..
Rhynchonellid, indet.	2519	..	..	..
Atrypa reticularis L. sp. ..	..	2509	..	..
Gasteropoda, indet.	2505	2511	..	..
Styliola fissurella Hall, var. *multistriata* Chapm.	..	2498	..	..
(?) *Orthoceras* sp.	2482	2498, 2499, 2501, 2502, 2504, 2506	..	..
(?) *Protophragmoceras* sp. ..	2483	..	..	..
(?) cf. *Bronteus enormis* Eth. fil.	2495	..	..	..
Phacops sweeti Eth. fil. and Mitch.	2493	..	..	..
(?) *Phacops* sp.	2519	2496	..	..
Trilobite remains, indet. ..	2488	..	562	..
Beyrichia maccoyiana Jones, var. *australiæ* Chapm.	2493	..	..	..
Ostracoda, indet.	2488	..	562	..

Explanation of Plates.

XLVI.

Fig. 1.—*Receptaculites fergusoni* Chapman. Polished face of section passing horizontally through the summit plates of the interior of cup and across the ends of pillars at the lower right hand corner. Griffith's Quarry, Loyola. M.D No. 2482. × ⅔

Fig. 2.—*R. fergusoni* Chapman. A magnified horizontal section through summit plates. M.D. No. 2482. (Slide No. 1386.) × 6.

Fig. 3.—*R. fergusoni* Chapm. Summit plates in oblique section; also a pillar cut transversely. M.D. No. 2482. (Slide No. 1386.) × 6.

Fig. 4.—*R. fergusoni* Chapm. Section through several pillars. M.D. No. 2482. (Slide No. 1386.) × 6.

XLVII.

Fig. 5.—*Cyathophyllum approximans*, sp. nov. Transverse section of corallum. Cooper's Creek, Thomson River. A. W. Cresswell col.. (Nat. Mus.) × 6.

Fig. 6.—*C. approximans*, sp. nov. Portion of corallum, weathered surface. Cooper's Creek. M.D. No. 746. Natural size.

XLVIII.

Fig. 7.—*Phillipsastræa walli* R. Etheridge fil. Weathered surface of corallum. Griffith's Quarry, Loyola. M.D. No. 2489. Nat. size.

Fig. 8.—*P. walli* Eth. fil. Vertical section of corallum. Griffith's Quarry, Loyola. M.D. No. 2491. (Slide No. 1375.) × 6.

Fig. 9.—*P. walli* Eth. fil. Horizontal section of corallum, showing the thin-walled septa. Griffith's Quarry. Loyola. M.D. No. 2491. (Slide No. 1374.) × 6.

XLIX.

Fig. 10.—*Phillipsastræa speciosa*, sp. nov. Weathered surface of corallum. Griffith's Quarry, Loyola. M.D. 2487. Nat. size.

Fig. 11.—*P. speciosa*, sp. nov. Horizontal section of corallum. Griffith's Quarry, Loyola. M.D. No. 2487. (Slide No. 1387.) × 6.

L.

Fig. 12.—*P. speciosa*, sp. nov. Vertical section of corallum. Griffith's Quarry, Loyola. M.D. No. 2487. (Slide No. 1388.) × 6.

Fig. 13.—*P. speciosa*, sp. nov. Horizontal section of corallite more highly magnified, showing carinate and perforate septa. Griffith's Quarry, Loyola. M.D. No. 2487. (Slide No. 1387.) × 35.

Fig. 14.—*P. speciosa*, sp. nov. Horizontal section of corallite, showing perforate septa. M.D. No. 2487. (Slide No. 1388.) × 35.

LI.

Fig. 15.—*Columnaria* (*Loyolophyllum*) *cresswelli*, sub. gen. et sp. nov. Horizontal section of corallum, showing well-preserved septa extending to centre of corallites. Loyola. Cresswell coll. (Nat. Mus.) × 15.

Fig. 16.—*C.* (*L.*) *cresswelli*, sub gen. et sp. nov. Vertical section of corallum, showing curved tabulae, outer vesicular zone, and striated epithecal walls. Cresswell coll. (Nat Mus.) × 15.

LII.

Fig. 17.—*Columnaria* (*Loyolophyllum*) *cresswelli*, sub. gen. et sp. nov. Young corallum, peduncular view. Griffith's Quarry, Loyola. M.D. No. 2494. × $\frac{3}{2}$.

Fig. 18.—*C.* (*L.*) *cresswelli*, sub gen. et sp. nov. Horizontal section of a corallum of a badly-preserved example. Griffith's Quarry, Loyola. M.D. No. 2488. (Slide No. 1373.) × 6.

LIII.

Fig. 19.—*Favosites forbesi* Edwards and Haime. Vertical section of corallum, showing variable size of corallites and changes in the direction of growth. Deep Creek, Thomson R. M.D. No. 573. (Slide No. 1324.) × 6.

Fig. 20.—*Favosites gothlandica* Lamarck. Vertical section of corallum, showing thin corallite walls, mural pores, vestiges of septa, and closely set tabulae. Deep Creek, Thomson R. M.D. No. 589. (Slide No. 1331.) × 6.

LIV.

Fig. 21.—*Favosites nitida*, sp. nov. Vertical section of corallum. Deep Creek, Thomson R. M.D. No. 564. (Slide No. 1318.) Cotype. × 6.

Fig. 22.—*F. nitida*, sp. nov. Oblique section of corallum. Deep Creek, Thomson R. M.D. No. 588. (Slide No. 1330.) Paratype. × 6.

Fig. 23.—*F. nitida*, sp. nov. Horizontal section of corallum, showing spinose septa. Deep Creek, Thomson R M.D. No. 576. (Slide No. 1325.) Cotype. × 6.

LV.

Fig. 24.—*Favosites nitida*, sp. nov. Vertical section of corallum. Deep Creek, Thomson R. M.D. No. 592. (Slide No. 1333.) Paratype. × 15.

Fig. 25.—*F. nitida*, sp. nov. Vertical section of corallum, showing mural pores and vestiges of spinose septa. Cooper's Creek. M.D. No. 749. (Slide No. 1335.) Cotype. × 15.

LVI.

Fig. 26.—*Favosites* sp. Transverse section of a branching form. Deep Creek, Thomson R. M.D. No. 571. (Slide No. 1322.) × 15.

Fig. 27.—*Favosites forbesi* Edwards and Haime. Section through the peduncular part of a corallum. Deep Creek, Thomson R. M.D. No. 568. (Slide No. 1320.) × 6.

LVII.

Fig. 28.—*Pachypora alterivalis*, sp. nov. Section of corallum, nearly vertical, adjacent to the coenosteum of a *Clathrodictyon* (cf. *regulare* Rosen sp.). Deep Creek, Thomson R. M.D. No. 562. (Slide No. 1317.) × 6.

Fig. 29.—*P. alterivalis*, sp. nov. Portion of corallum in section, more highly magnified. Deep Creek, Thomson R. M.D. No. 562. (Slide No. 1317.) × 15.

LVIII

Fig. 30.—*Alveolites* sp. aff. *suborbicularis* Lamarck. Section of corallum. Deep Creek, Thomson R. M.D. No. 575. (Slide No. 1321.) × 6.

Fig. 31.—*Fistulipora victoriae*, sp. nov. Weathered surface of corallum. Griffith's Quarry, Loyola. M.D. No. 2486. Cotype. × $\frac{3}{2}$.

LIX.

Fig. 32.—*Fistulipora victoriae*, sp. nov. Tangential section of corallum. Griffith's Quarry, Loyola. M.D. No 2486. (Slide No. 1457.) × 15.

Fig. 33.—*F. victoriae*, sp. nov. Transverse section of corallum; outer zone. Griffith's Quarry, Loyola. M.D. No. 2486. (Slide No. 1458.) × 15.

Fig. 34.—*F. victoriae*, sp. nov. Transverse section of corallum; central area. Griffith's Quarry, Loyola. M.D. No. 2486. (Slide No. 1458.) × 15.

LX.

Fig. 35.—*Heliolites interstincta* Linné, var. *gippslandica*, var. nov. Vertical section of corallum. Cooper's Creek. M.D. No. 746. × 6.

Fig. 36.—*H. interstincta* L., var. *gippslandica*, var. nov. Transverse section, slightly oblique, of corallum. Cooper's Creek. M.D. No. 746. (Slide No. 1336.) × 6.

LXI.

Fig 37.—*Clathrodictyon* cf. *regulare* Rosen sp. Vertical section. Deep Creek, Thomson R. M.D. No. 562. (Slide No. 1317.) × 6.

Fig. 38.—(?)*Protophragmoceras* sp. Exterior of shell. Griffith's Quarry, Loyola. M.D. No. 2483. About nat. size.

Fig. 39.—(?)*Protophragmoceras* sp. Photograph of face of median section. Griffith's Quarry, Loyola. M.D. No. 2483. × $\frac{5}{4}$.

PLATE XLVI.

FIG. 1. ×$\frac{3}{4}$.

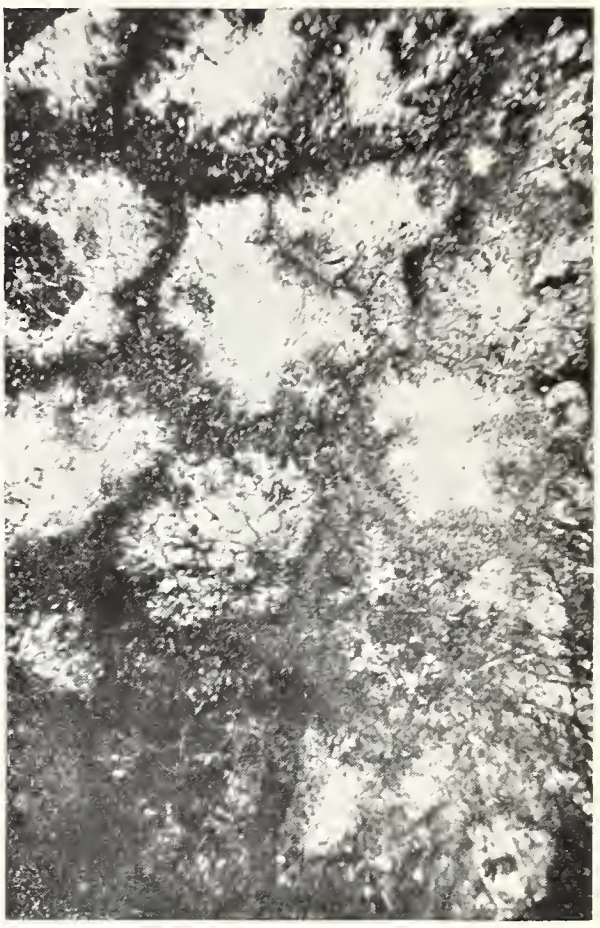

FIG. 2. ×6.

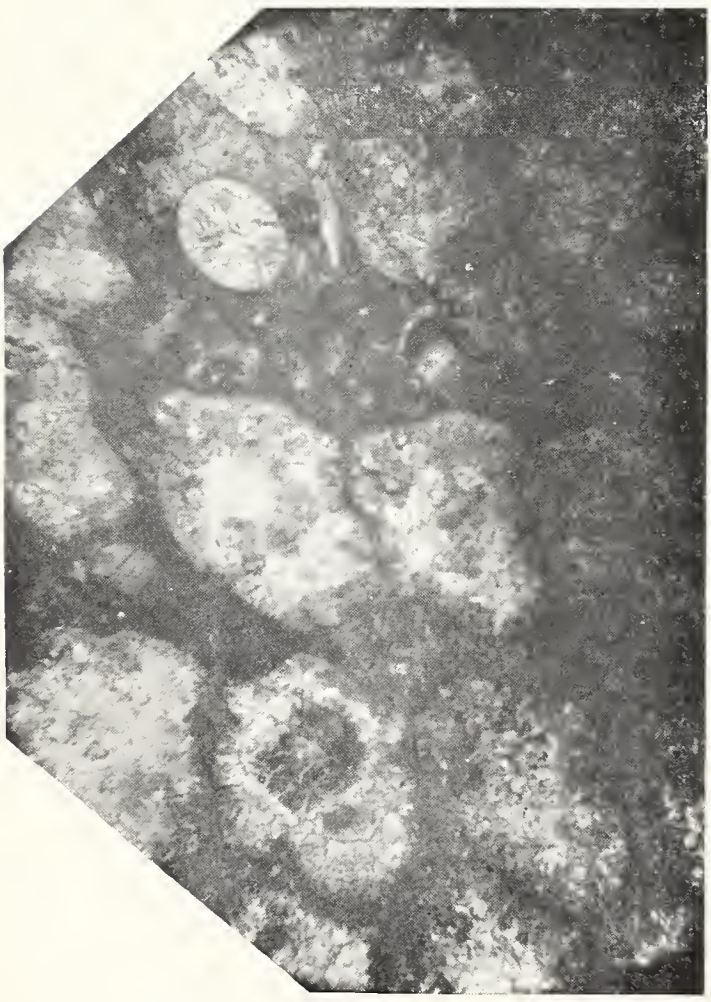

FIG. 3. ×6.

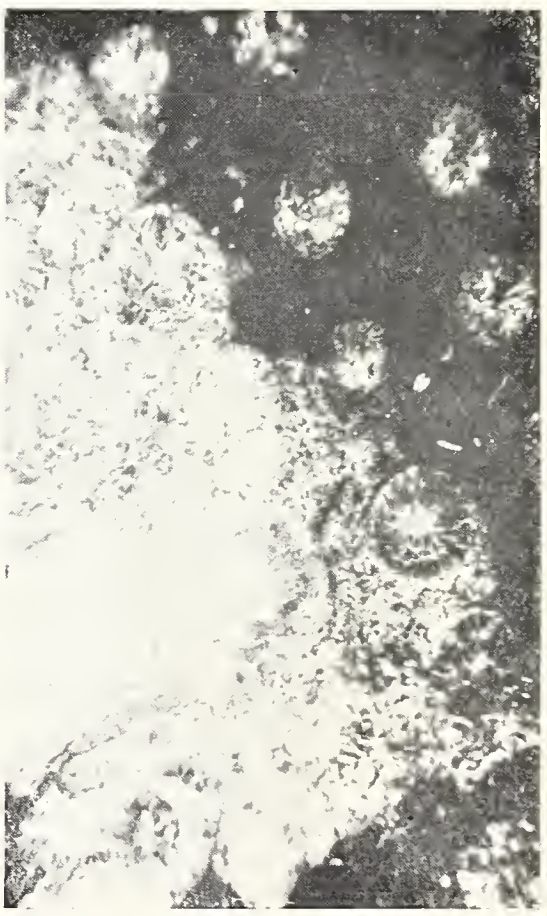

FIG. 4. ×6.

F. C., Photo.

RECEPTACULITES FERGUSONI CHAP. : LOYOLA.

14476.

BRITISH MUSEUM
G D
NATURAL HISTORY

Plate XLVII.

Fig. 5. ×6.

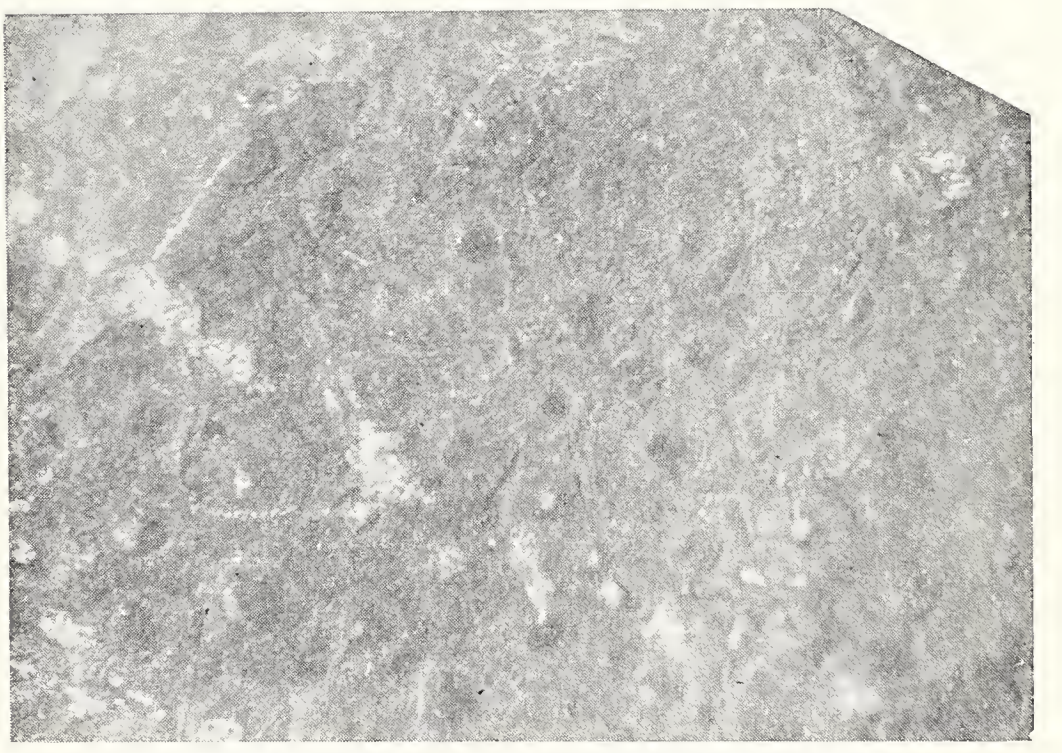

Fig. 6. nat. size.

F. C., Photo.

CYATHOPHYLLUM APPROXIMANS SP. NOV.: COOPER'S CREEK.

BRITISH MUSEUM
G D
NATURAL HISTORY

Plate XLVIII.

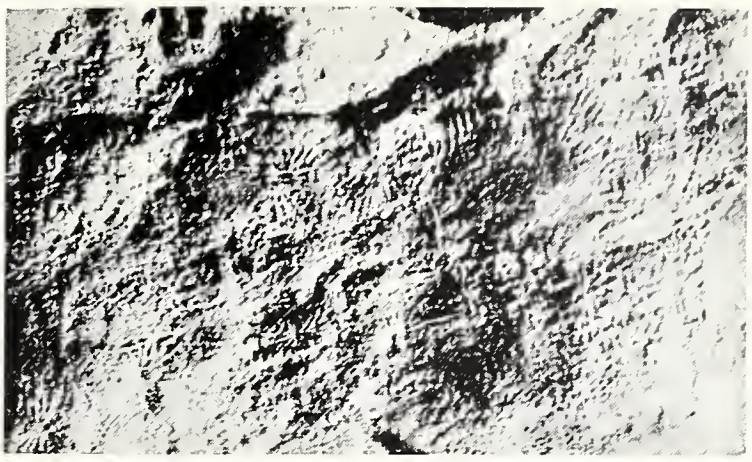

Fig. 7. nat. size.

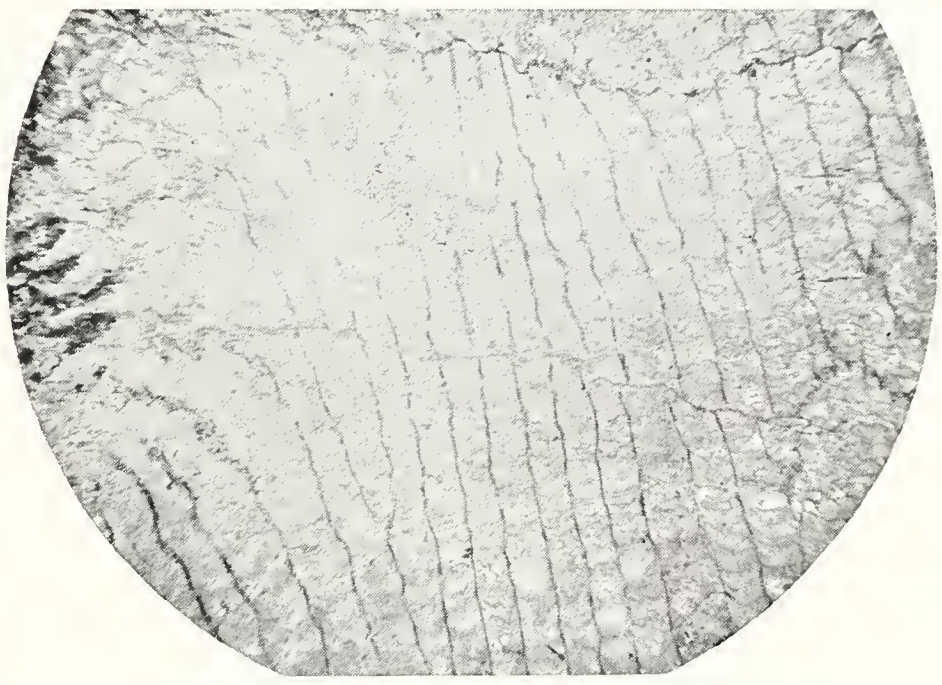

Fig. 8. ×6.

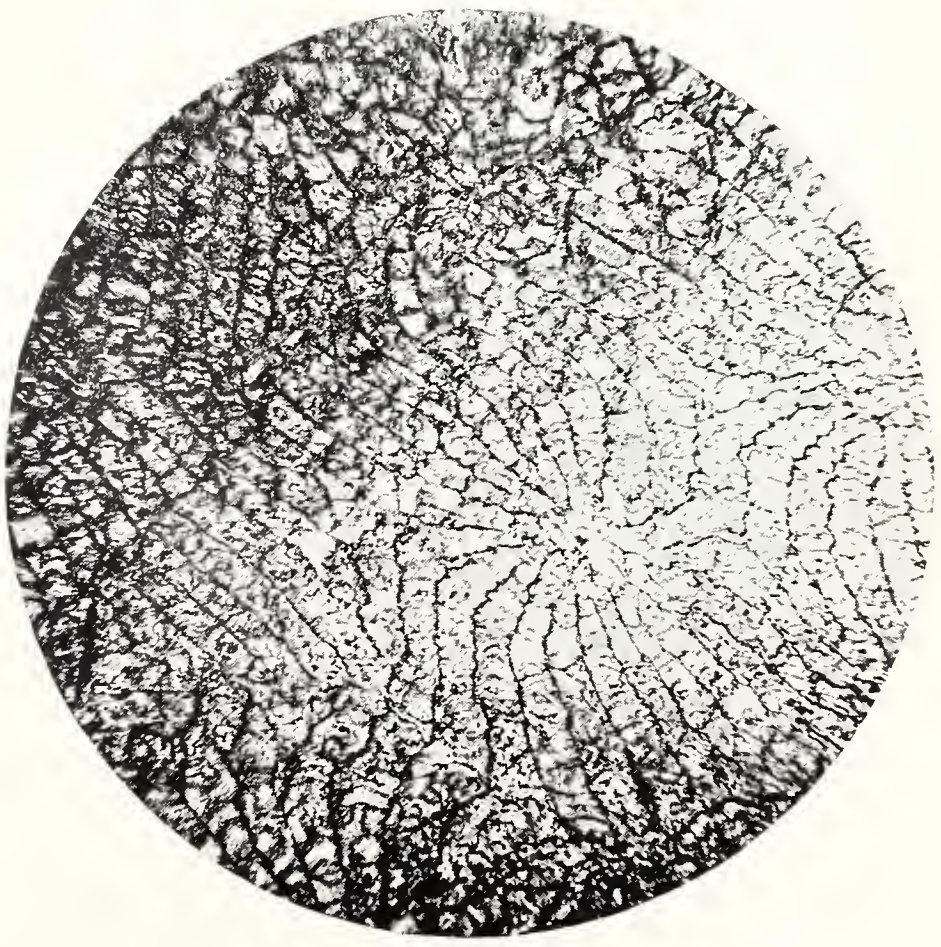

Fig. 9. × 6.

F. C., Photo.

PHILLIPSASTRÆA WALLI ETH. FIL. : LOYOLA.

BRITISH MUSEUM
G D
NATURAL HISTORY

Plate XLIX.

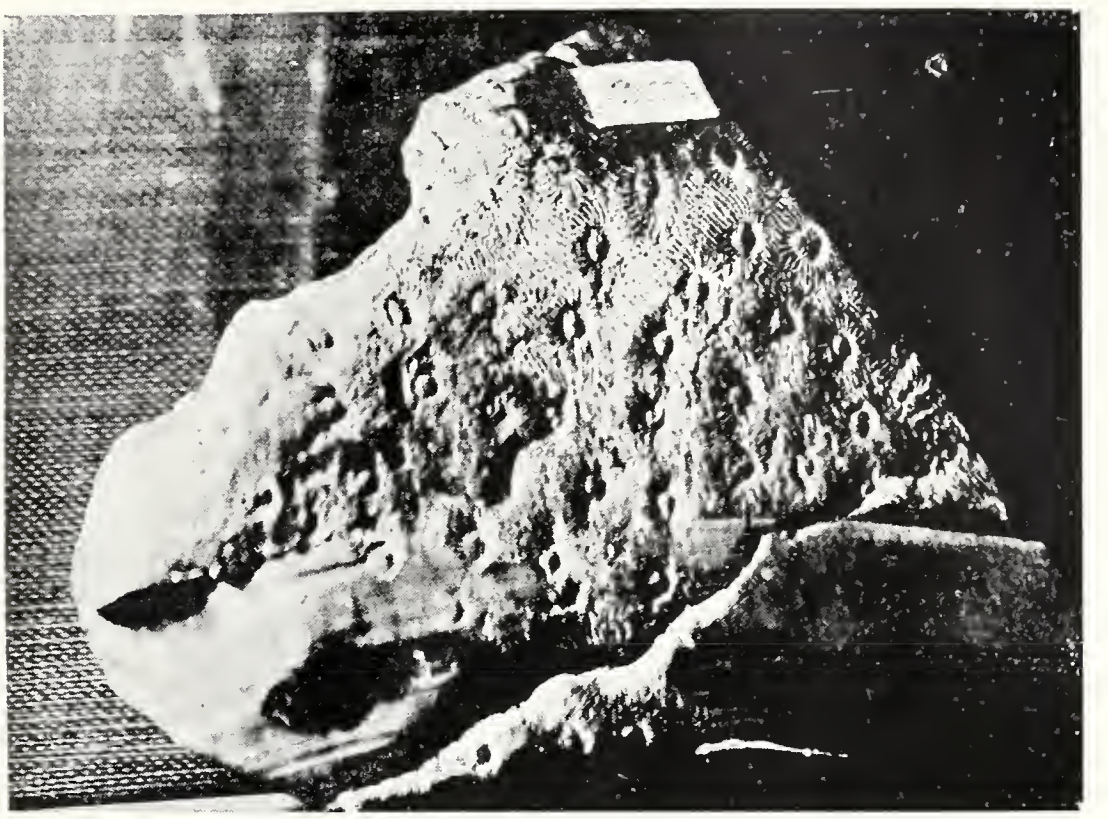

Fig. 10. nat. size.

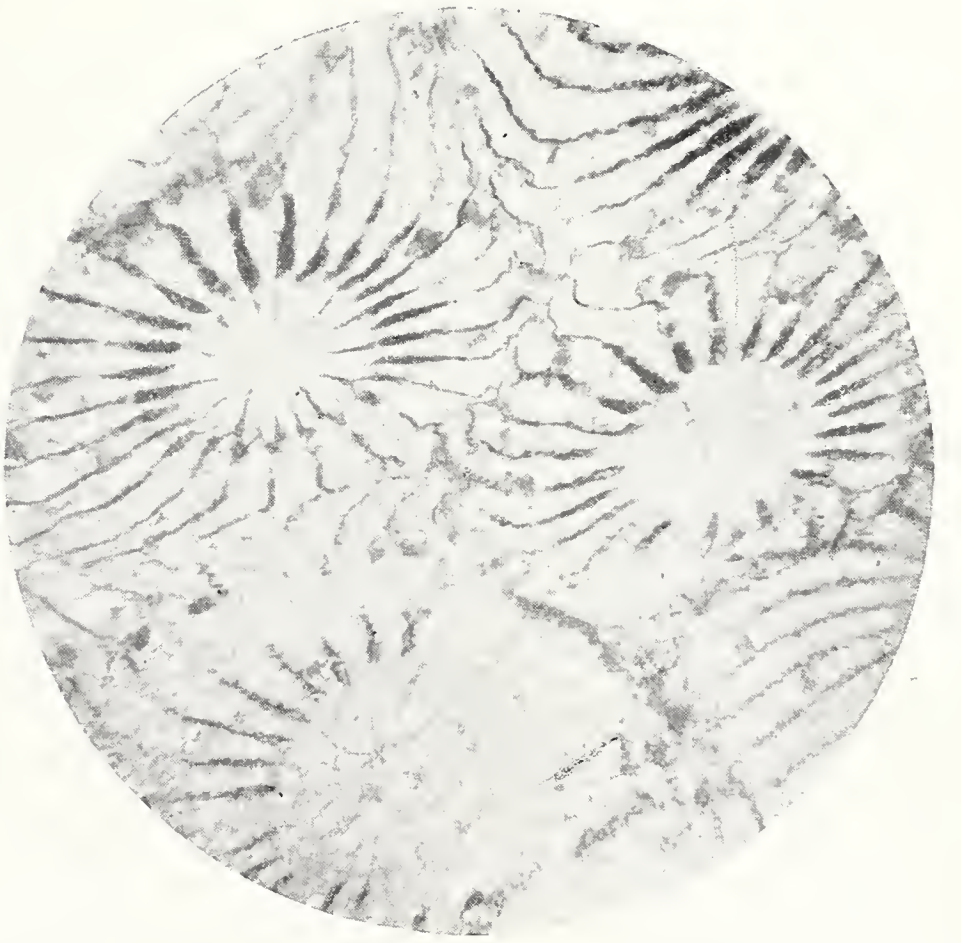

Fig. 11. ×6.

F. C. Photo.

PHILLIPSASTRÆA SPECIOSA SP. NOV. : LOYOLA.

BRITISH MUSEUM
G D
NATURAL HISTORY

Plate L.

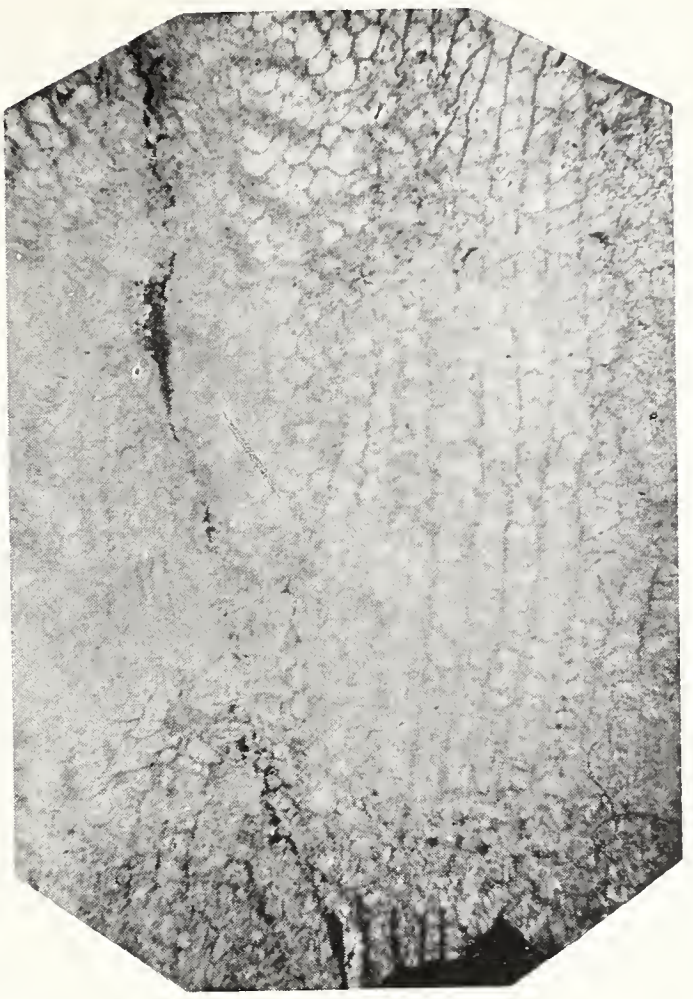

Fig. 12. ×6.

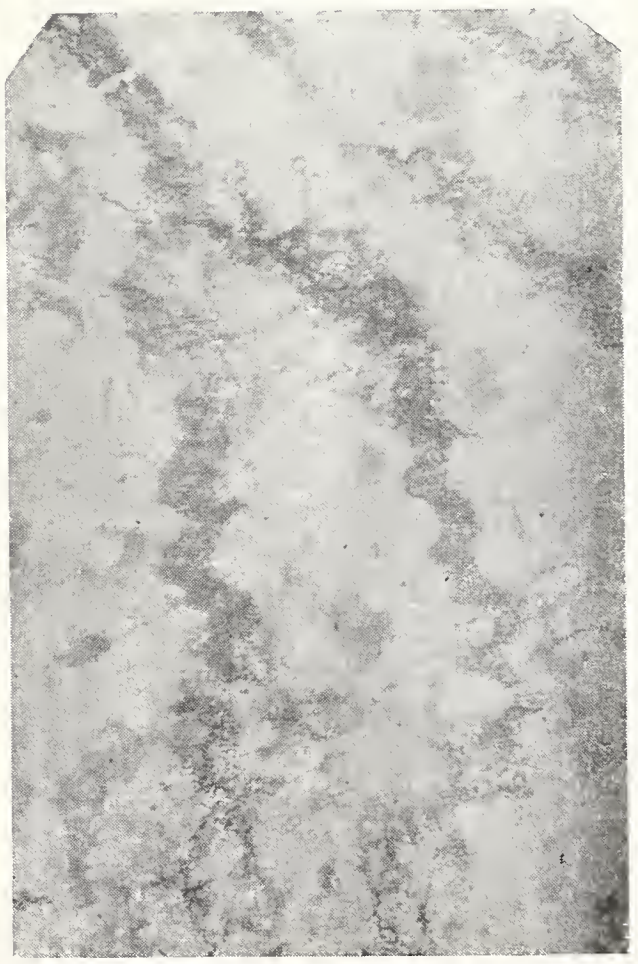

Fig. 13. 5 3. ×

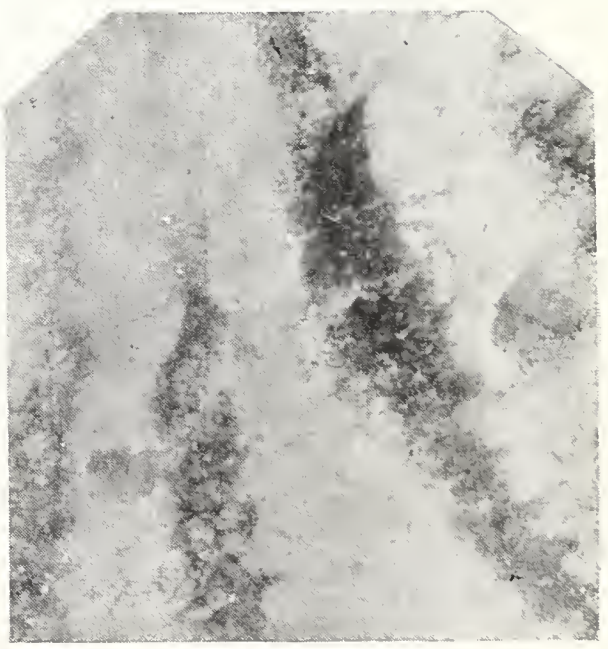

Fig. 14. ×35.

F. C., Photo.

PHILLIPSASTRÆA SPECIOSA SP. NOV. : LOYOLA.

BRITISH MUSEUM
G D
NATURAL HISTORY

Plate LI.

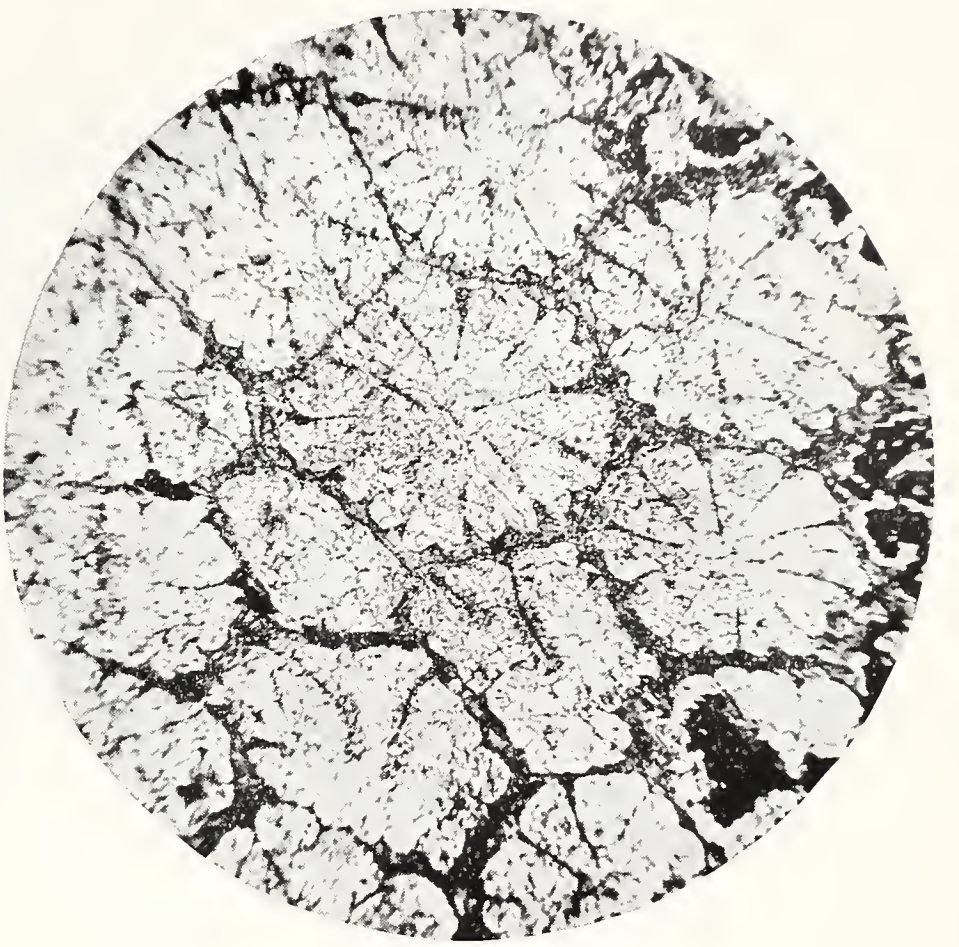

Fig. 15. × 15.

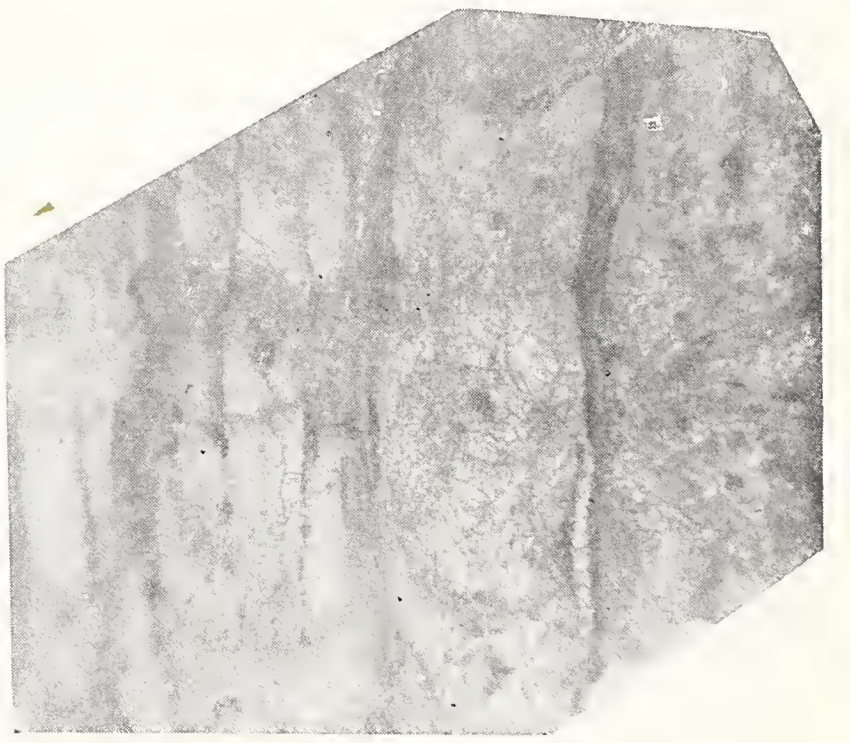

Fig. 16. × 15.

F C., Photo.

COLUMNARIA (LOYOLOPHYLLUM) CRESSWELLI, SUB-GEN. ET SP. NOV.: LOYOLA.

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NATURAL HISTORY

PLATE LII.

FIG. 17. ×$\frac{3}{2}$.

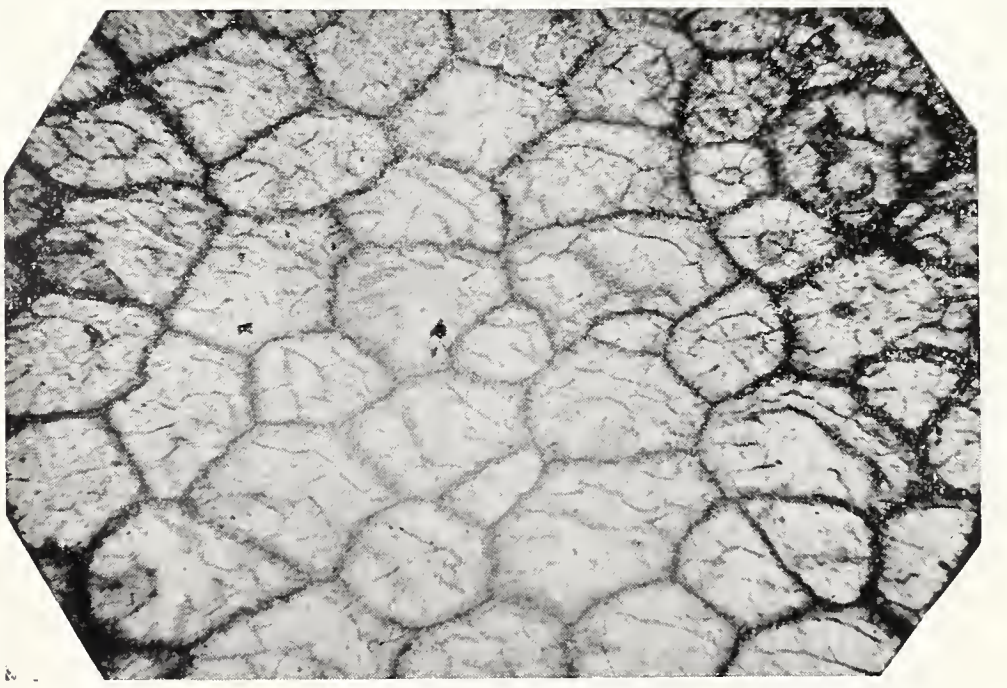

FIG. 18. ×6.

F. C., Photo.

COLUMNARIA (LOYOLOPHYLLUM) CRESSWELLI, SUB-GEN. ET SP. NOV. LOYOLA.

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NATURAL HISTORY

Plate LIII.

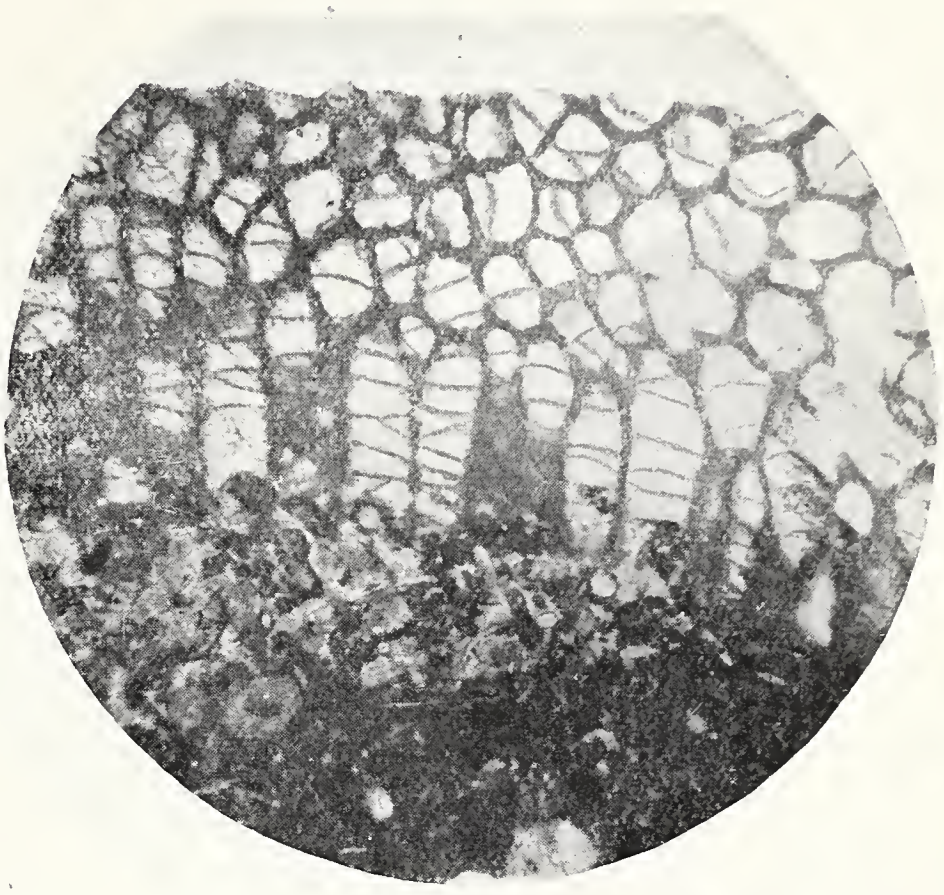

Fig. 19. ×6.

Fig. 20. ×6.

F. C., Photo.

FAVOSITES : DEEP CREEK, THOMSON RIVER.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LIV.

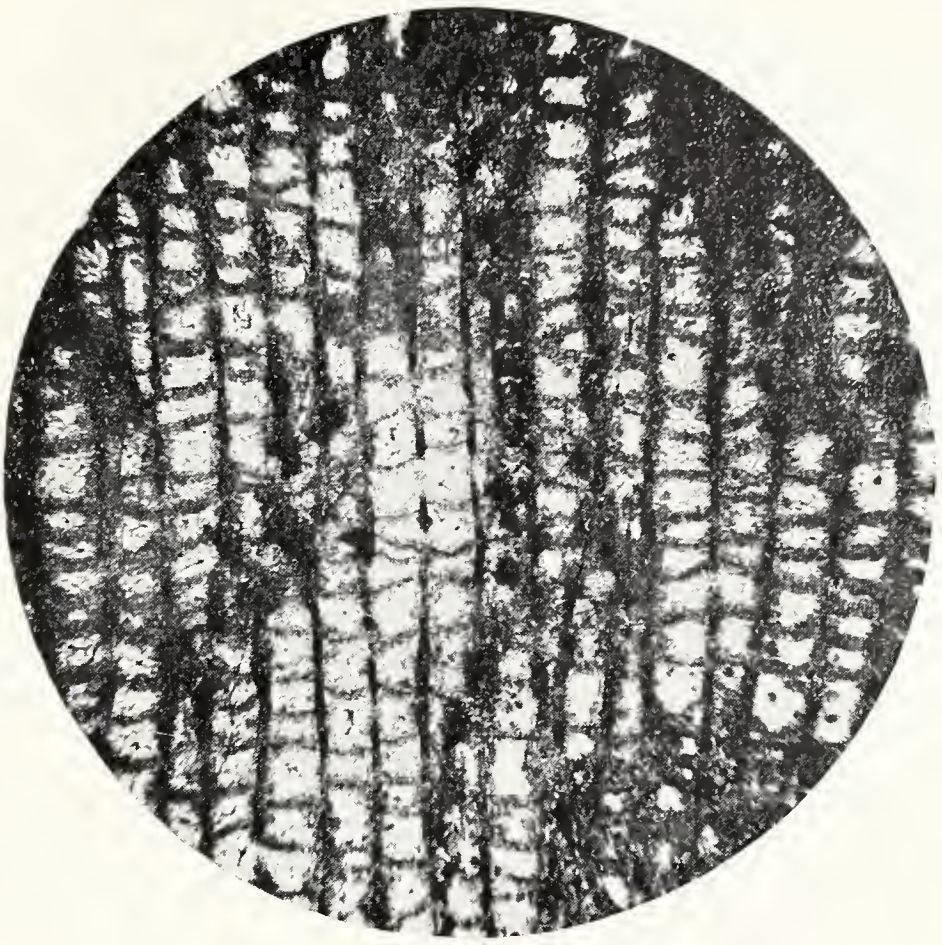

Fig. 21. ×6.

Fig. 22. ×6.

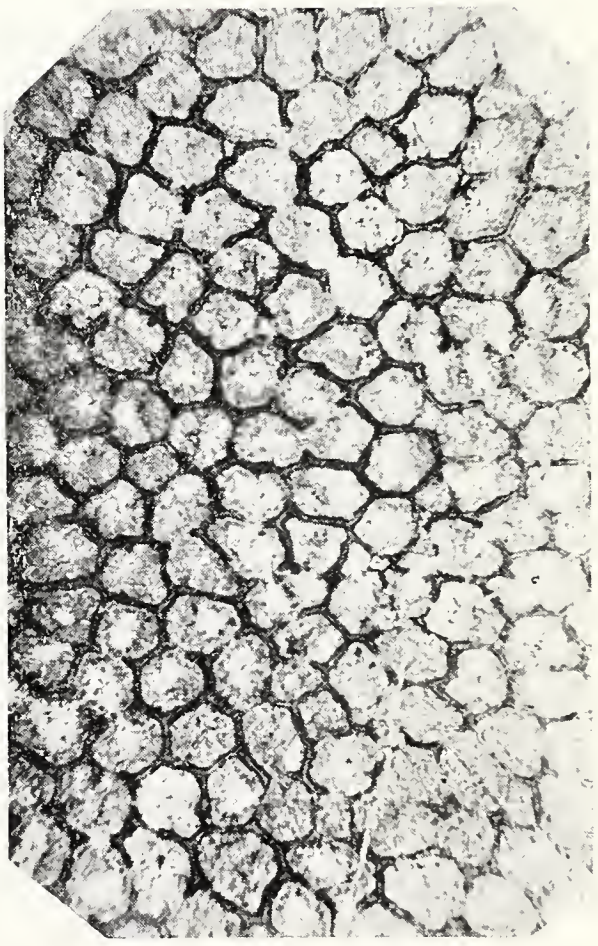

Fig. 23. ×6

F. C., Photo.

FAVOSITES NITIDA SP. NOV. : DEEP CREEK, THOMSON RIVER.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LV.

Fig. 24. ×15.

Fig. 25. ×15.

F. C., Photo.

FAVOSITES NITIDA SP. NOV. : DEEP CREEK AND COOPER'S CREEK.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LVI.

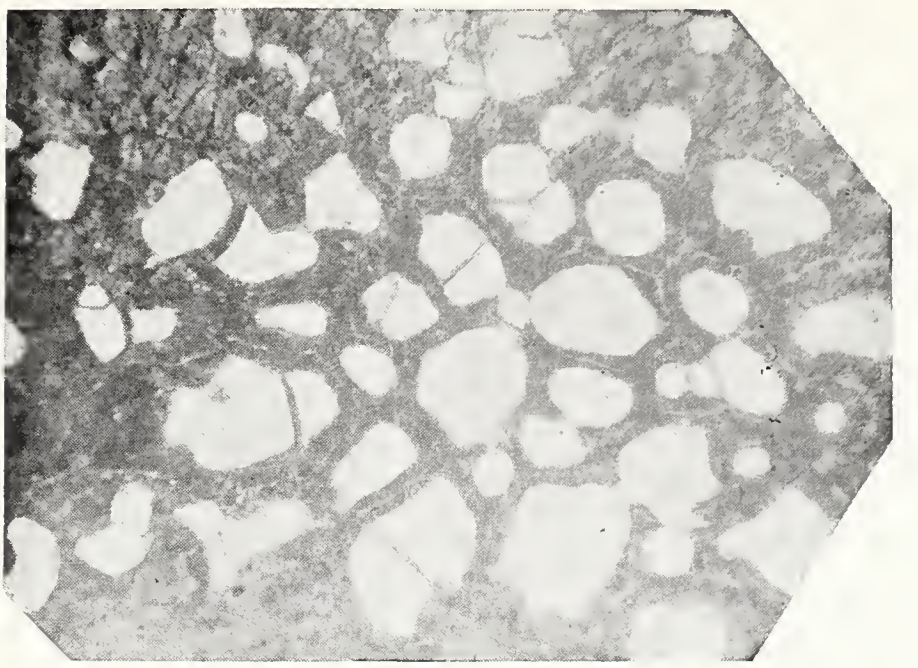

Fig. 26. ×15.

Fig. 27. ×6.

F. C., Photo.

FAVOSITES : DEEP CREEK, THOMSON RIVER.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LVII.

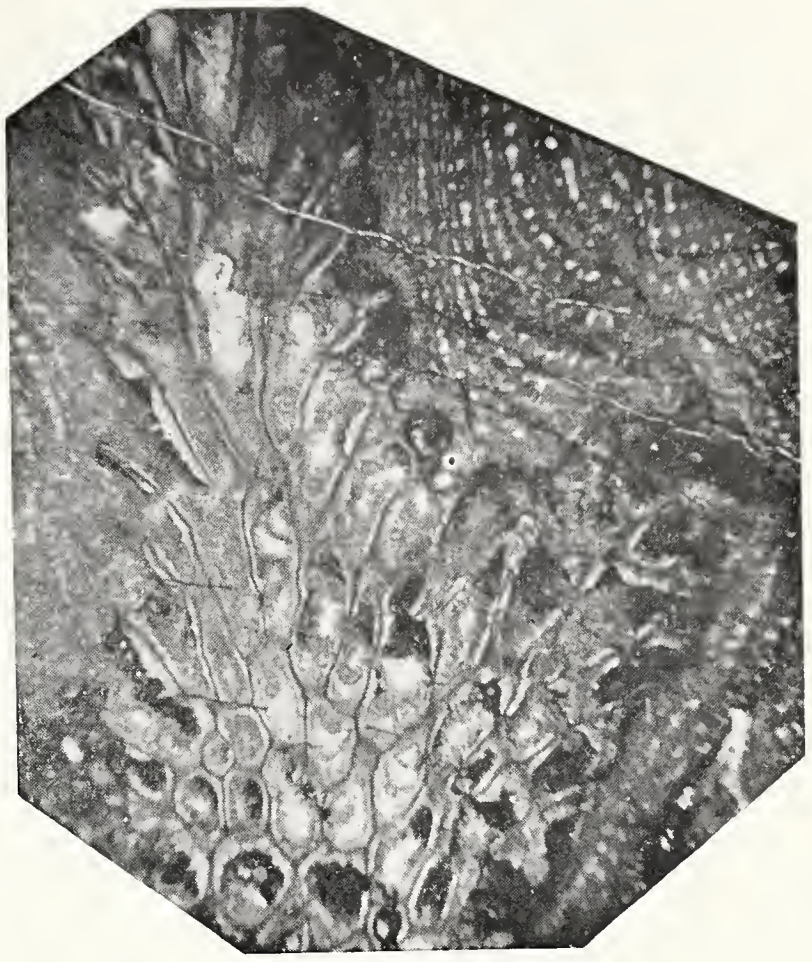

Fig. 28. ×6.

Fig. 29. ×15.

F. C., Photo.

PACHYPORA ALTERIVALIS SP. NOV. : DEEP CREEK, THOMSON RIVER.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LVIII.

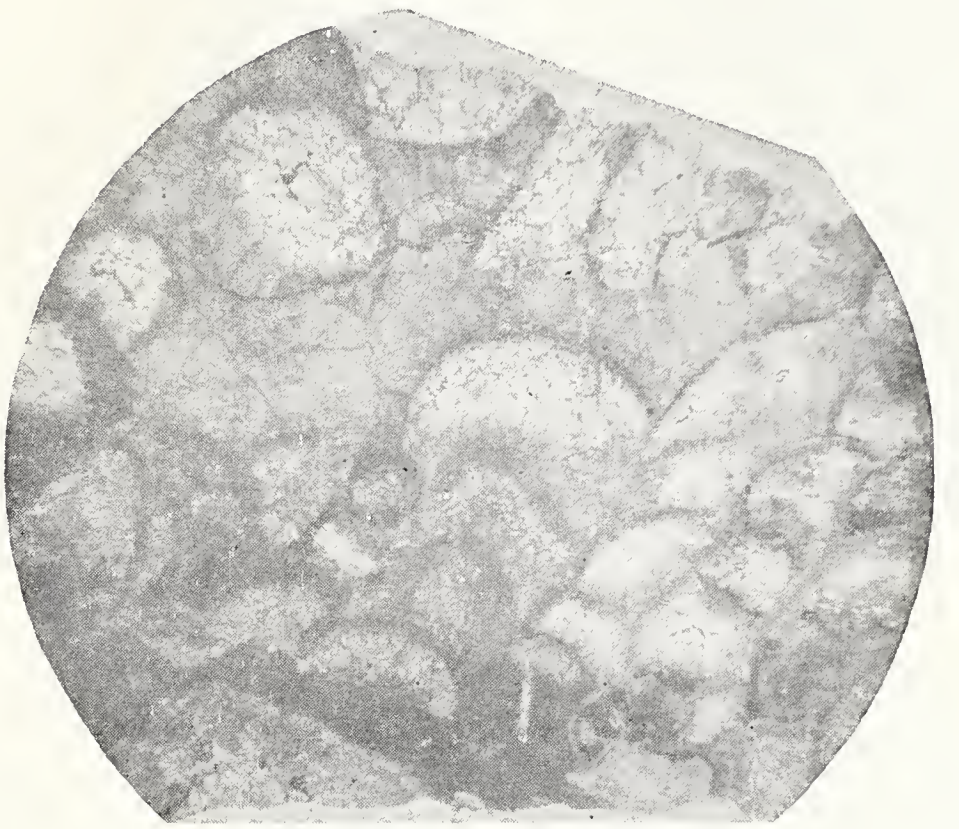

Fig. 30. ×6.

Fig. 31. $\times \frac{3}{2}$.

F. C., Photo.

ALVEOLITES AND FISTULIPORA: DEEP CREEK AND LOYOLA.

BRITISH MUSEUM
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NATURAL HISTORY

Plate LIX.

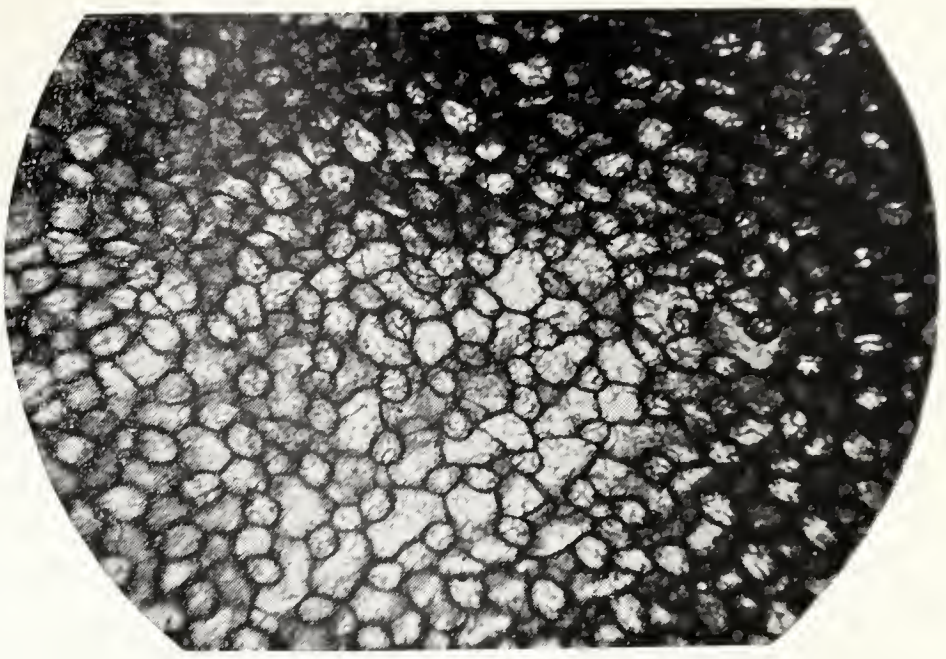

Fig. 32. ×15.

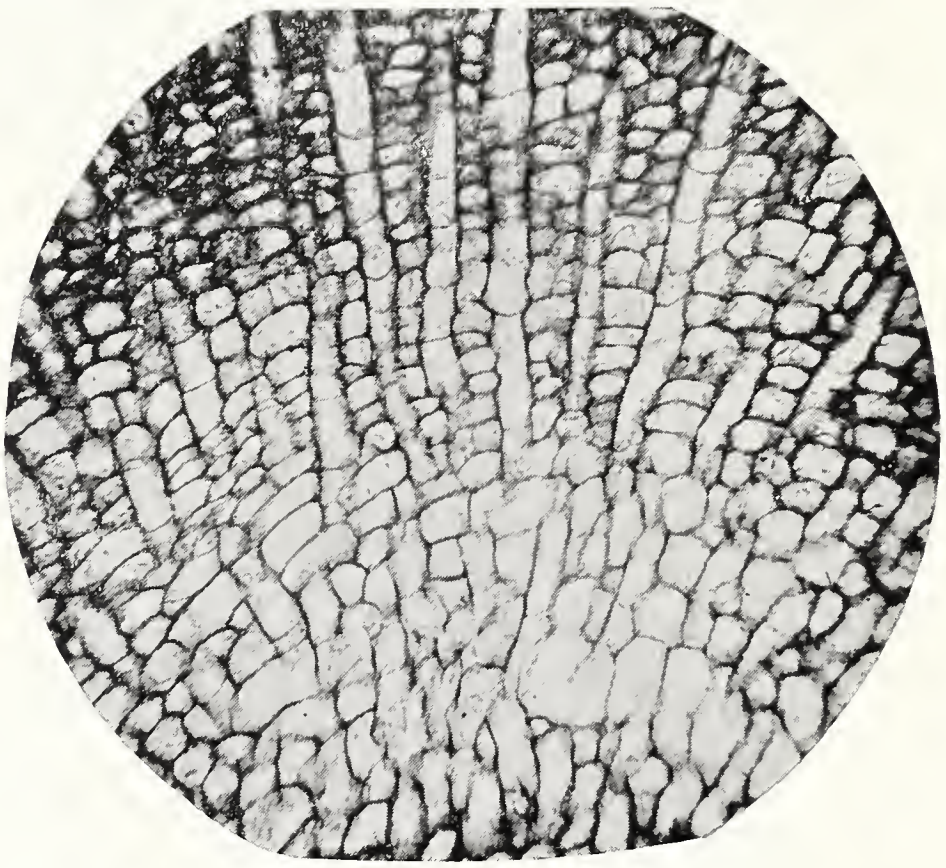

Fig. 33. ×15.

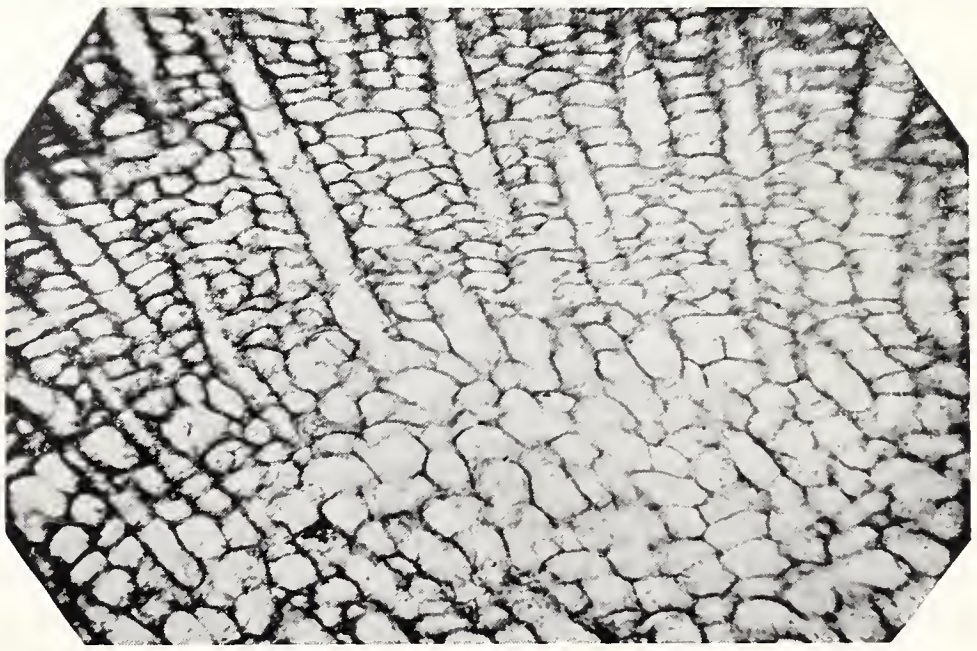

Fig. 34. ×15.

F C., Photo.

FISTULIPORA VICTORIÆ SP. NOV.: LOYOLA.

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NATURAL HISTORY

Plate LX.

Fig. 35. ×6.

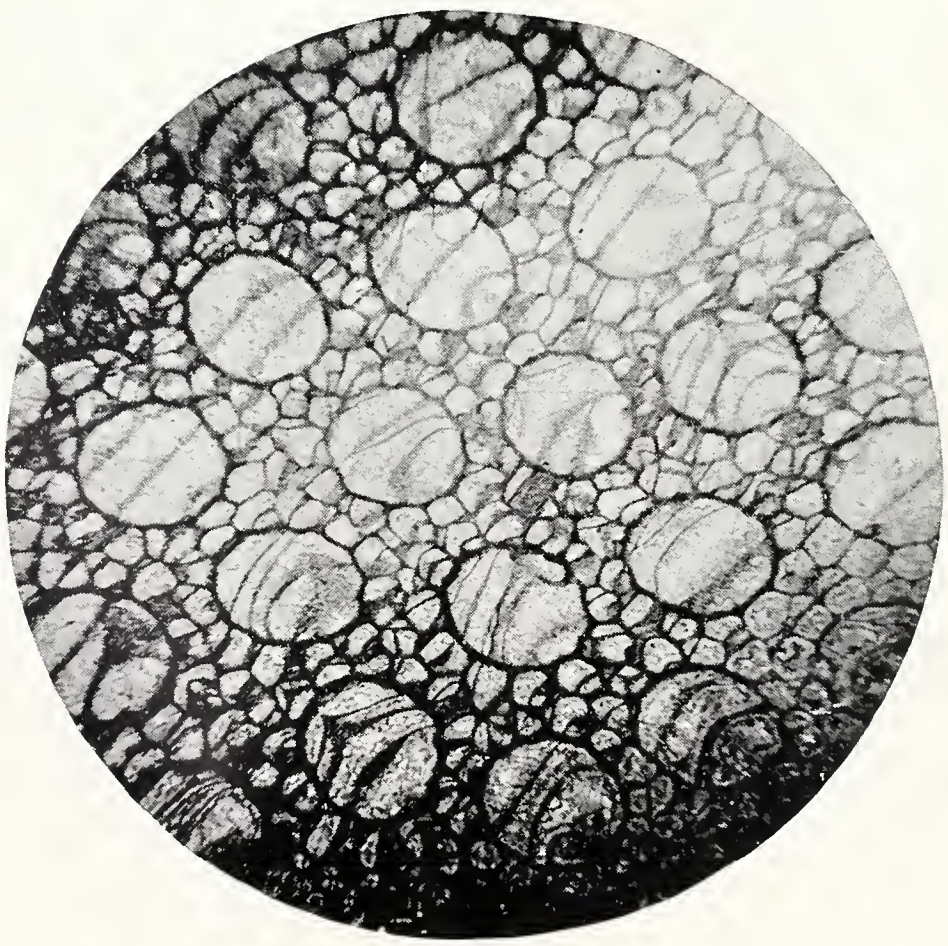

Fig. 36. ×6.

F. C., Photo.

HELIOLITES INTERSTINCTA L. SP., VAR. GIPPSLANDICA, VAR. NOV.: COOPER'S CREEK, THOMSON RIVER.

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NATURAL HISTORY

Plate LXI.

Fig. 37. ×6.

Cir. nat. size.

Fig. 38.

Fig. 39. ×$\frac{5}{4}$.

F. C., Photo.

CLATHRODICTYON AND (?) PROTOPHRAGMOCERAS : DEEP CREEK AND LOYOLA.

BRITISH MUSEUM
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NATURAL HISTORY

MISCELLANEOUS REPORTS ON FOSSILS.

By Frederick Chapman, A.L.S., F.R.M.S., Palaeontologist to the National Museum, Melbourne.

Samples from Bores at Wonthaggi.

Collected by L. H. Ower.

Specimen Nos. 11626 and 11627. Bore No. 175. Depth, 760 feet. State Coal Mine Area.

This core (the two opposite faces of one block), contains a very interesting organic structure in the form of a nearly straight series of elongate-ovate to sub-circular segments, joined end to end like a string of sausages, and of almost equal diameter throughout. At the node between the second and third perfect segment from one end, there is a bulbous shoot at right angles to the main series, almost circular in outline; whilst on the opposite side is a single, slender internode, distinctly grooved longitudinally. The tuberous series measures 86mm. in length. The tubers of the main series are 8 to 15mm. long and about 8mm. wide. The internode is 8.5mm. in length, and 4.25mm. in width. (See Plate LXII.)

This fossil specimen is undoubtedly referable to a tuberous underground shoot of an equisetalean, and similar to the structure found in living examples of the genus *Equisetum*.

The nodal diaphragms of an *Equisetites* have already been described from the Jurassic of South Gippsland, at Kongwak, by Mr. A. C. Seward[1]; and a fluted stem with node, by the writer, from Kilcunda[2].

The present occurrence of this particular morphological structure in the equisetales appears to be the first recorded for Australia. It may be possible, eventually, to correlate the previously described occurrences of *Equisetites* in the Jurassic of South Gippsland with this portion of the plant; and for convenience, we may refer to the present specimen as *Equisetites wonthaggiensis*, sp. nov.

In other countries fossil plant remains referred to the tuberous shoots of *Equisetites* are perhaps most commonly found in the Wealden, as in *E. Burchardti* Dunker, from Westphalia, and Hastings, Sussex, England; as well as in *E. Yokoyamae* Seward, also from Sussex.[3] In the Trias these tubers occur in *E. arenaceus* Bronn sp., in Europe[4]; in the Jurassic, in *E. Burejensis* Heer, from Siberia[5]; and in the Tertiary, in *E. Parlatori* Heer, from Switzerland[6], *E. arcticum* Heer, from Spitzbergen[7], and *E. Winkleri* Heer, from Iceland[8].

There can be little question that the present core comes from Jurassic strata. The shale is horizontally bedded, and is of a dark bluish grey, and similar to other samples from the same area with typical Jurassic plant-remains.

[15.5.11.]

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1. Rec. Geol. Surv Vic., vol. I., pt. 3, 1904, p. 160.
2. *Ibid.* vol. III., pt. 1, 1909, p. 105.
3. *Vide* Seward's *Fossil Plants*, vol. I., 1898, pp. 279 and 280, figs. 65 and 66.
4. *Vide* Schimper, Traité Pal. Vég. 1874, pl. X., figs. 8 and 9.
5. Heer. Flora fossilis Arctica, 1877, vol. V., p. 89. pl. XXII.
6. Heer. Flora Tertiaria Helvetiae, Winterthur, 1855, vol. III., p. 158, pl. CXLV.
7. Heer. Flora fossilis Arctica, vol. II 1870 (Die Miocene Flora und Fauna Spitzbergens), p. 31, pl. I. figs. 1, 2, 5, 6, 12 and 13.
8. Flora fossilis Arctica, vol. I., 1868, p. 140, pl. XXIV., fig. 6.

Nos. 11628 and 11629. Bore No. 177. Depth, 800 feet. Parish of Wonthaggi East.

This rock, judging from its structure and composition, is in all probability palaeozoic. It is a greenish, muddy, micaceous sandstone, having a very steep dip (55°). The two surfaces of the core bear the impression of a brachiopod fragment, which is finely, radiately striate, and with a median sinus; from its imperfect condition, however, it is impossible to indicate even the genus.

Nos. 11634-11636. Bore 186. Depth, 250 feet. Near C. Patterson.

Cone-scales and leaves of *Araucarites* sp.

11635. In addition to the above, fragments of leaves of *Taeniopteris* sp. occur.

Nos. 11637, 11638. Bore 175. Depth, 500 feet. About 7 ch. S.E. of No. 5 shaft, State Coal mine.

Two opposite halves of a core containing the tuberous rhizome of *Equisetites wonthaggiensis* Chapm.

Explanation of Plate LXII.

Fig. 1.—*Equisetites wonthaggiensis*, sp. nov. Tuberous rhizome with internode. Jurassic. Core No. 11626. State Coal Mine Area, Wonthaggi. Bore No. 175, depth 760 feet. Nat. size.

Fig. 2.—Tuberous rhizome of *Equisetum arvense* L. (After Schimper, Traité Pal. Vég., 1874, pl. VII., fig. 6.)

Fig. 3.—Tuberous rhizome of *Equisetites Parlatori* Heer. (From Schimper, ibid., pl. VIII., Fig. 13.)

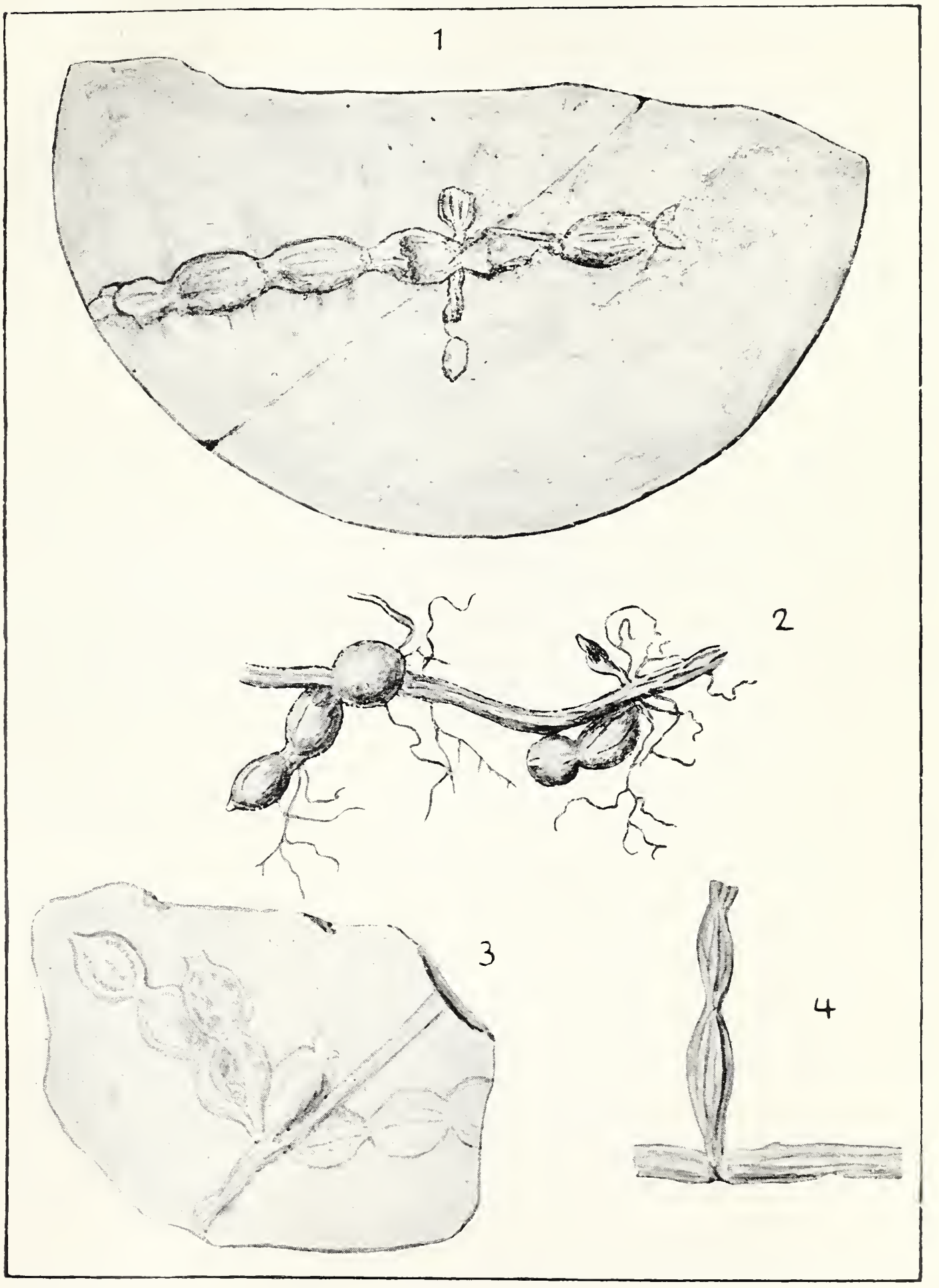
Fig. 4.—Tuberous rhizome of *Equisetites Parlatori* Heer. (From Schimper, ibid., pl. VIII., fig. 14.)

A Polyzoal and Foraminiferal Limestone from Cape Schanck.

The specimen now described is of special interest for two reasons. Firstly, it shows the occurrence of a polyzoal limestone containing the important foraminiferal genus *Lepidocyclina* in a new locality; and secondly, it affords conclusive evidence of the affinity of the polyzoal limestone of Flinders with the Batesford *Lepidocyclina* limestones in the Geelong area. The rocks from all three localities are therefore referable to the polyzoal phase of the Janjukian.

The present sample was discovered and collected by Mr. R. A. Keble, and its precise locality is 1 mile N.W. of the junction of the Lighthouse and Sorrento roads, at the back of Cape Schanck. This limestone occurs as a small patch, resting on the older basalt in a similar manner to the Flinders limestone.

Plate LXII.



F. C., del

TUBEROUS SHOOTS IN EQUISETITES AND EQUISETUM : WONTHAGGI, ETC.

BRITISH MUSEUM
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The polyzoal rock at Flinders contains, besides polyzoa, numerous lenticular tests of *Amphistegina*[1], but up to the present no examples of the genus *Lepidocyclina* have been there met with. In the present specimen from Cape Schanck, however, in addition to numerous *Amphisteginae*, there are some occasional tests of *Lepidocyclina tournoueri*, identical with those found in the Miocene of Europe (Burdigalian) and in the Janjukian of Batesford[2], and in western Victoria at Grange Burn.

Microscopic Structure of the Limestone.

In thin section, under a moderately high power, this rock is seen to consist of numerous polyzoan fragments, tests of *Amphistegina, Operculina, Globigerina, Discorbina*, and *Pulvinulina*, with occasional shell fragments, both bivalves and brachiopods, as well as sections of echinoid spines and plates. This organic fragmentary material is cemented into fairly compact rock by a fine, crystalline, grey mud. Where the peripheries of the foraminiferal tests project into a cavity their surfaces are often coated with a minute fringe of calcite scalenohedra.

Fossils Identified in the Present Sample.

Plantae—

Lithothamnion spp.

Foraminifera—

Globigerina sp.
Discorbina dimidiata Parker and Jones.
Pulvinulina schreibersii d'Orb. sp. (sharply keeled var.).
Polystomella crispa Linné sp.
Amphistegina lessonii d'Orb. (very common).
Operculina complanata Defr.
Lepidocyclina tournoueri Lemoine and Douvillé.

Polyzoa—

Cellaria sp.
Lepralia sp.
Retepora sp.

Brachiopoda—

Terebratulina sp. nov.

Cirripedia—

(?) *Balanus* sp.

Age of the Rock—Cainozoic; Janjukian.

Fossils from Warrandyte.

These specimens were collected by Mr. A. M. Howitt, and the locality is marked on his map which appeared in Part I. of this volume, Plate V.

Fossiliferous sandstone, Caledonia Consols. Nos. 1481-6.

Internal casts and moulds of crinoid stems abundant in all specimens.

A ramose coral, indet. No. 1484.

Cast of a minute encrusting stromatoporoid, probably allied to *Clathrodictyon*. No. 1485.

Age—Silurian.

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1. Recorded by Mr. A. E. Kitson as *Nummulites variolaria* Sow. Rec. Geol. Surv. Vic., vol. I., pt 1. 1902, p. 51.

2. See Proc. R. Soc. Vic., vol. XXII. (N.S.) pt. II. 1910, pp. 295, 296, pl. IV., figs. 1, 2, 6.

Fossils from the Jamieson District.

(Nos. 6065-6073 and Nos. 6077-6085.)

Collected by O. A. L. Whitelaw.

No. 6066. Opposite junction of Edwards' Creek and Goulburn River.

A coarse conglomerate with pebbles of black shale and white quartz. Numerous cavities testify to the former existence of fossils now entirely removed, but the moulds are so weathered as to defy determination.

Nos. 6067 and 6068. Swampy Creek, 30 chains above junction with Pheasant Creek.

No. 6067.—Black micaceous shales. Weathered surface of bedding plane covered with irregular, subcylindrical bodies resembling worm castings or infilled burrows. Similar remains from the Palaeozoic rocks have been referred to fucoids, as *Palaeophycus*.

No. 6068.—A sandy mudstone, unfossiliferous. Surface of bedding plane covered with a thin layer of hardened micaceous mud, which is intersected by fracture lines nearly at right angles to one another. It is very doubtful whether this is due to sun-cracks and it is possibly caused by the subsequent baking of the rock and sudden differential contraction of the finer layer.

Nos. 6069-6073. Spur between Wheeler's and Moat's Creeks, one mile above Hickey's Bridge.

Ochreous sandstone filled with casts of crinoidal stems. Originally an arenaceous, crinoidal limestone. No determinable fossils in 6069-6071, but 6072 and 6073 contain (?) *Orthis* (casts).

No. 6078-6085. On road from Ten Mile to Gaffney's Creek, 5 chains above junction of Edwards' Creek and Goulburn River.

Plant remains, indet.

There is no very definite evidence of age from the above fossils, but they presumably occur high in the Silurian series. The appearance of the plant remains last mentioned tends to confirm this, since similar forms have already been found associated with Yeringian beds in other parts of Gippsland.

Nos. 8048-8055. From tramway of Britannia Mine, Ten Mile, 1 chain N. of battery.

A fossiliferous conglomerate with ferruginous casts and moulds of shells, &c. Remains of corals, crinoids, brachiopods and trilobites, for the most part indeterminate.

(?) *Fistulipora*. No. 8053.

Orthis cf. *elegantula* Dalman. No. 8050.

Orthis cf. *testudinaria* Dalman. Nos. 8050, 8055.

Age—Silurian (? Yeringian).

Nos. 8056-8060. From spur on W. side of Stony Creek, 4 chains from junction with Goulburn River, near Ten Mile.

Fossiliferous sandstone and grit. Fossils represented by hollow casts; chiefly small ramose fistuliporoids, crinoid stems and brachiopods, indet.

Age—Silurian (? Yeringian).

Nos. 8062-8064. Mount Terrible Spur, 20 chains east of Specimen Mine, Ten Mile.

Plant remains, indet., in ochreous and brown micaceous sandstone. These fossils closely resemble those of the Avon River sandstones.

Age—Palaeozoic. Horizon doubtful, but probably Lower Carboniferous.

Nos. 8065-8077. On tramway; 1½ chains above battery, Britannia Mine, Ten Mile.

Fossiliferous conglomerate composed of the remains of corals, brachiopods and gasteropods; chiefly as casts and moulds.

Mould of a portion of a crinoid stem with a badly preserved cast of the crown; indeterminate, but probably referable to the *Ichthyocrinidae* (including *Taxocrinus*). The mould of the stem shows numerous conspicuous pits, representing the bases of cirri. Specimen No. 8065.

Gasteropods, cf. *Euomphalus* (internal casts). Nos. 8071, 8076.

Orthis cf. *testudinaria* Dalman. No. 8068.

Age—Silurian (? Yeringian).

Nos. 8078-8084. Same locality as Nos. 8065-8077.

Arenaceous and micaceous shale with plant remains, indet.

The remarks given under Nos. 8062-8064 also apply to these specimens.

Age—Palaeozoic. Horizon doubtful, but probably Lower Carboniferous.

No. 8061. Griffith's Lime Quarry, Howe's Creek, near Mansfield.

An olive-brown felspathic sandstone with plant stem. Judging from the undulating sclerenchymatous strands seen on the surface, and the great width of the stem, there is very little doubt that this specimen is a denuded *Lepidodendron* stem. A specimen of a *Lepidodendron* stem in a precisely similar matrix from Mansfield occurs in the National Museum collection.

Age—Lower Carboniferous.

FURTHER NOTES ON AUSTRALITES.

By E. J. Dunn, F.G.S., late Director, Geological Survey.

Since Bulletin 27 (Australites) was published, additional material bearing on the subject has been secured, and is embodied in the following notes :—

Black Basalt.

In Selwyn's Quarter-Sheet 9 S.E., showing the country around Kyneton, this note is inserted over an area lying between the Coliban and Little Coliban Rivers, and about $2\frac{1}{2}$ miles S.W. from Kyneton township—"A black, jetty, very dense, slaggy-looking basalt is found all over the ground without appearing anywhere in place."

This rock extends for a length of about half a mile, and is found in the northern portion of allotment 308 and in the N.E. corner of allotment 307, parish of Lauriston. It occurs as loose, very irregular fragments and blocks, ranging to over 50 lb. in weight, scattered over the northern portion of the area, evidently the remains of an irregular sheet, all of which has decomposed except the loose pieces. Very red soil has resulted in places from the decomposition of this rock. In the southern portion of the area this black basalt, which resembles lydianite in appearance, is met with in place, as an irregular sheet between flows of grey vesicular basalt. Nowhere was it observed to exceed a foot in thickness.

This basalt is an acidic rock, as shown by an analysis published in Selwyn's catalogue of 1868, page 23. The composition is as under :—

Analysis by J. Cosmo Newbery.

	Per cent.
Silica	61.96
Alumina	17.23
Manganese	0.96
Iron	10.43
Lime	5.36
Magnesia	3.24
Potash }	2.10
Soda }	
Titanic acid	0.60
Water	0.07
	101.95

Waterworn pebbles of this acidic basalt are abundant along the course of the Coliban River, from the Upper Coliban Reservoir to Taradale, and still further down stream in the Recent alluvial gravel. but are not present in the auriferous alluvial leads of Tertiary age. Pebbles of this basalt are also found in the Coliban River for 2 miles above the reservoir. but sparsely distributed. None were observed so high up as Trentham.

The rugged, irregular, and extremely rough forms that the remnants of this rock assume as a result of decomposition are remarkable. They somewhat resemble the forms met with in obsidian on the Great Barrier Island, New Zealand.

Owing to the hardness and sub-conchoidal fracture of this basalt, it was peculiarly suitable for forming the weapons and implements required by the aboriginals, and it was largely used by them. Chips of this material are found for long distances around where this rock crops out.

Obsidian.

Associated with the pebbles of black basalt along the course of Coliban River, from the Upper Coliban Reservoir to Taradale, are well rounded pebbles of black obsidian. They were first obtained by the writer four years ago at Taradale, but they were assumed to be black basalt. Recently their true character was recognised, and an analysis was made.

No pebbles of obsidian were found above the outlet of the Upper Coliban Reservoir. The obsidian is a dull black in colour, with conchoidal fracturing all over the surface from impact with other pebbles. It breaks with perfect conchoidal fracture, is jet black on fracture, and resembles bitumen in lustre; it is opaque to semi-opaque. Occasional examples of red and black obsidian occur. The obsidian pebbles have a peculiarly rough feel, while those of black basalt are smooth to the touch.

There appears to be every gradation from black basalt having uneven fracture and dull lustre to obsidian with conchoidal fracture and vitreous lustre. Examples are to be found showing the various stages. The obsidian pebbles are more spheroidal in form than those of black basalt. The difference in material may account for this. None of the pebbles of obsidian were found as much as 1 lb. in weight. They are far less abundant than the pebbles of black basalt, and would not amount to 1 per cent. as compared with them.

From the association of obsidian and black basalt pebbles along the course of the river, and from the manner in which the black basalt grades into obsidian, it is to be inferred that both originate at the same locality. Obsidian was not observed *in situ* where the black basalt is found in place, but careful search would probably result in its discovery.

The analysis of the obsidian was made at the Geological Survey Laboratory by Mr. J. C. Watson, and the result is given below. For comparison, No. 7 analysis of an australite from the table on page 8 of Bulletin 27 is placed beside it:—

(No. 1) Taradale Obsidian.		(No. 2) No. 7 Australite.	Difference between 1 and 2.	Range of difference in 9 Australites.
SiO_2	63·67 per cent.	64·68 per cent.	1·01 per cent.	13·04 per cent.
Al_2O_3	15·83 ,, ,,	16·80 ,, ,,	0·97 ,, ,,	6·83 ,, ,,
Fe_2O_3	1·39 ,, ,,	6·57 ,, ,,	5·18 ,, ,,	6·30 ,, ,,
FeO	4·06 ,, ,,	1·01 ,, ,,	3·05 ,, ,,	4·29 ,, ,,
MgO	2·15 ,, ,,	2·50 ,, ,,	0·35 ,, ,,	1·02 ,, ,,
CaO	3·88 ,, ,,	3·88 ,, ,,	0·00 ,, ,,	1·48 ,, ,,
Na_2O	3·57 ,, ,,	trace	3·57 ,, ,,	1·76 ,, ,,
K_2O	3·69 ,, ,,	4·01 ,, ,,	0·32 ,, ,,	3·08 ,, ,,
H_2O+	0·02 ,, ,,	...	...	
H_2O-	0·15 ,, ,,	..	...	...
TiO_2	1·27 ,, ,,	...	...	...
P_2O_5	0·02 ,, ,,	...	...	...
MnO	0·43 ,, ,,	...	...	...
NiO & CoO	0·01 ,, ,,	...	...	...
	100·14	99·45	...	...
Sp. gr. 2·569		...	...	..

From the above analyses it is apparent that No. 7 australite of page 8, Bulletin 27, differs less in composition from the Taradale obsidian than it does from some of the other australites. Only one example of this obsidian has been analyzed, but if a series of analyses were made it is probable that

there would be discovered a wide range in composition. This is the more probable from the fact that the black basalt grades into obsidian in different samples of that rock. It is now proved that acidic volcanic glass, similar in composition to that of australites, exists in Victoria associated with the newer volcanic rocks.

In Victoria volcanic activity prevailed over a wide area from Miocene times to the beginning of the Recent period, and extensive areas of the surface were covered by material poured out of volcanoes as lava or hurled out of their throats as agglomerate or lapilli.

Although the volcanic fires may have burned intermittently at any particular site, they may have burned continuously in one place or another over the affected area throughout the great lapse of time that separated the Miocene from the Recent outbreaks.

The volcanic rocks of Victoria range from basic to highly acidic, and the glassy forms of these rocks, as might be expected, range widely in their silica contents.

In Selwyn's catalogue, 1868, page 80, the following analyses are given, made by J. Cosmo Newbery :—

	Specimen 21— Australite.	Specimen 24— Obsidian, Geelong District.	Specimen 24A— Blue Obsidian, Geelong.
Silicia	73·70 per cent.	72·23 per cent.	68·45 per cent.
Sesquioxide of Iron ...	6·08 ,, ,,	2·28 ,, ,,	7·21 ,, ,,
Alumina	4·99 ,, ,,	16·43 ,, ,,	5·38 ,, ,,
Lime	4·20 ,, ,,	3·17 ,, ,,	8·11 ,, ,,
Magnesia	0·10 ,, ,,	2·12 ,, ,,	1·03 ,, ,,
Peroxide of Manganese ...		...	0·50 ,, ,,
Titanic Acid		...	0·30 ,, ,,
Soda	5·20 ,, ,,	4·65 ,, ,,	7·36 ,, ,,
Potash	4·83		
Loss by ignition ...	0·55 ,, ,,	0·13 ,, ,,	...
	99·65	101·01	98·34
Sp. gr.	2·47	2·41	2·36

At Meredith (Victoria), Mr. Ferguson, of the Geological Survey staff, discovered a tachylite of bluish colour on the outside and bluish black on the fracture. Part consists of glass, and portions are spherulitic. An analysis of the glassy portion was made by Mr. A. G. Hall, of the Geological Survey Laboratory, and is given below :—

SiO_2	50·87 per cent.
Al_2O_3	14·33 ,, ,,
Fe_2O_3	5·37 ,, ,,
FeO	7·25 ,, ,,
MgO	4·51 ,, ,,
CaO	8·22 ,, ,,
Na_2O	3 39 ,, ,,
K_2O	1·35 ,, ,,
H_2O+	0·17 ,, ,,
H_2O-	0·33 ,, ,,
TiO_2	3·38 ,, ,,
P_2O_5	0·07 ,, ,,
Cl	... Strong trace
MnO	0·58 ,, ,,
NiO and CoO	0·06 ,, ,,
CoO	trace
	99·88

Sp. gr. 2·831.

Distribution of Australites.

The undermentioned additional localities where australites have been found in West Australia have been furnished by Mr. Simpson, Analyst, of Perth; Mr. Thorp, of Derby, West Australia; and Mr. Alexander, of Ararat, Victoria; and additional localities in New South Wales by Mr. G. W. Card, Mines Museum, Sydney:—

West Australia.

Yilgangi, 60 miles E. of Menzies.
Edjudina.
Linden.
Bremmer Bay.
Esperance.
Meckerring.
Cucubbing.
Fitzgerald Peaks.
Woodgina.
Where proposed Transcontinental Railway enters West Australia.
100 miles N. of Esperance Bay.
Yilgarn.
Sir Samuel.
Mt. Catherine.
Mt. Ruth.
Tarri.
Mt. Wallbrook.
Williams.
Kookynie.
Saltwater River.
E. slope Stirling Range.
Lat. 25° 30′ S., Long. 123° E.
Mt. McGregor.

South Australia.

(Furnished by A. K. Ward, Government Geologist.)

Hergott Springs.
The Gawler Range.
Nullabor Plains.

New South Wales.

Liverpool.
Tumberumba.
Boggabri.
Wilson's Downfall.
Braidwood.

Tasmania.

Balfour, near Norfolk Range.

Source of the Australites.

As previously pointed out, the australites found east of a line drawn north and south through Daylesford, Victoria, have been remarkably few, probably not much more than a dozen or two altogether, and some of these have most certainly been in the possession of the aboriginals, and by this means have been transported from their original localities. Immediately to the westwards of the area where the greatest volcanic activity took place in Victoria—that is, in the Grampians—and to the north and south of that range, australites have been met with in greater abundance than anywhere else. Miners who originally worked the gullies for gold at Mount William, in the Grampians, have informed the writer that many pounds' weight of australites, sound and fragmentary, were found in some of the claims.

From the great volcanic area of Victoria australites have probably been distributed southward over the northern portion of Tasmania. In a north-west and west direction they have been dispersed practically over

the whole of South Australia and throughout Western Australia, south of the South Tropic. Northerly and easterly they appear to have been sparsely scattered from their apparent centre of distribution. The westward trend of the australites was probably governed by the direction of the air currents in the higher altitudes.

All the data so far obtained relating to the distribution of australites appear to point to the volcanic region of Victoria as the focus from which they have been distributed.

Resemblance in Tektites.

Where not abraded or recently flaked, the surfaces of australites are pitted in a peculiar manner. On comparing these pittings with the surface of billitonites, there is an unmistakable resemblance. Not only are the small vesicular pittings conspicuous in each, but the flow structure is also present in them both. Still further, the curious circular grooves and vermicular groovings so well marked on billitonites are imitated on australites also.

It is particularly to be noted that the pittings of australites occur not only on what were possibly original surfaces, but also on decidedly fractured surfaces that have since been weathered.

The surface pittings on australites and billitonites minutely resemble such as occur on a piece of obsidian obtained on the Great Barrier Island, New Zealand, and also resemble the pittings on moldavites from Moravia and other places in Bohemia, kindly sent me by Dr. Yezak, of Vienna. Some of these latter show flow structure as well as fine pittings.

On a moldavite from an ashbed of Mount Tairua, North Island of New Zealand, the surface pittings are of a peculiar character, and they are remarkably like surface markings on the Meredith tachylite.

The probabilities are that all these are products of volcanic activity that have been formed under differing conditions. In Bulletin 27 an analysis is given of what is considered to be marekanite, fragmentary obsidian ejected from a volcano. These obsidian fragments are found in an ashbed at the head of the Tairua River, New Zealand, and have evidently been ejected from a volcano.

In New Guinea, obsidian is abundant, as shown by samples sent to me by R. A. Vivian, Esq.. Samarai.

[4.7.13.]

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